COMPTON COLLEGE
INSTRUCTIONAL BUILDING #2

1111 East Artesia Blvd.
Compton, CA 90221

COMPTON COMMUNITY COLLEGE DISTRICT

1111 East Artesia Blvd.
Compton, CA 90221

DSA SUBMITTAL V2

April 8, 2019

tBP/Architecture
4611 Teller Avenue
Newport Beach, CA 92660
P: (949) 673-0300
F: (949) 732-3895

tBP Project No.: 20998.00

tBP
Architecture
Planning
Interiors
Management

This page intentionally left blank.

DOCUMENT 000107 - SEALS PAGE

ARCHITECT

tBP/Architecture, Inc.
4611 Teller Avenue
Newport Beach, CA 92660
P: (949) 673-0300
F: (949) 732-3895

License: Gary Paige Moon
C-25409 Exp. 07-31-19

CIVIL ENGINEER

FPL and Associates, Inc.
30 Corporate Park, Suite 401
Irvine, CA 92606
P: (949) 252-1688
F: (949) 252-0088

License: Alan Wing-Chi Lee
C-34971 Exp. 09-30-19

LANDSCAPE ARCHITECT

AHBE Landscape Architects
617West Seventh Street, Suite 304
Los Angeles, CA 90017
P: (213) 694-3800
F: (213) 694-3801

License: Calvin R. Abe
2032 Exp. 10-31-20

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP. 03-119458 INC:
REVIEWED FOR
SS ☑ FLS ☑ ACS ☑
DATE:05/23/2019

STRUCTURAL ENGINEER

VCA Engineers, Inc.
2151 Michelson Drive, #240
Irvine, CA 92612
P: (949) 679-0870
F: (949) 679-9370

License: Young-Keun Nam
S-4029 Exp. 09-30-20

PLUMBING AND MECHANICAL ENGINEER

Capital Engineering Consultants, Inc.
11020 Sun Center Drive, #100
Rancho Cordova, CA 95670
P: (916)851-3500

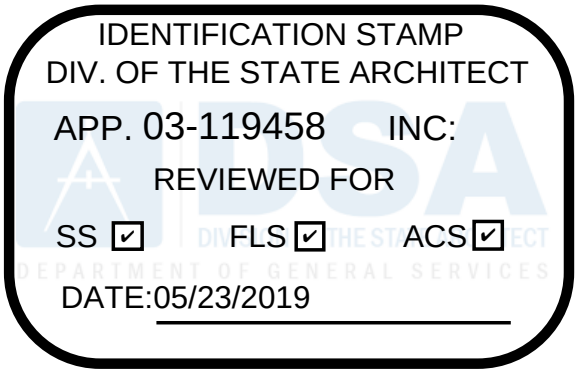
License: Matthew D. Ebejer
M-28774 Exp. 03-31-20

ELECTRICAL ENGINEER

FBA Engineering
150 Paularino Avenue, Suite A120
Costa Mesa, CA 92626
P: (949) 852-9992
F: (949) 853-1657

License: Stephen R. Zaucek
E-10372 Exp. 09-30-20

END OF DOCUMENT 000107



DOCUMENT 000110 - TABLE OF CONTENTS

DIVISION 15 - RESERVED

NOT USED

DIVISION 16 - RESERVED

NOT USED

DIVISION 17 - RESERVED

NOT USED

DIVISION 18 - RESERVED

NOT USED

DIVISION 19 - RESERVED

NOT USED

DIVISION 20 - RESERVED

NOT USED

DIVISION 21 - FIRE SUPPRESSION

DIVISION 22 - PLUMBING

DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING

DIVISION 33 - UTILITIES

DIVISION 34 - TRANSPORTATION

NOT USED

DIVISION 35 - WATERWAY AND MARINE CONSTRUCTION

NOT USED

DIVISION 36 - RESERVED

NOT USED

DIVISION 37 - RESERVED

NOT USED

DIVISION 38 - RESERVED

NOT USED

DIVISION 39 - RESERVED

NOT USED

DIVISION 40 - PROCESS INTEGRATION

NOT USED

DIVISION 41 - MATERIAL PROCESSING AND HANDLING EQUIPMENT

NOT USED

DIVISION 42 - PROCESS HEATING, COOLING, AND DRYING EQUIPMENT

NOT USED

DIVISION 43 - PROCESS GAS AND LIQUID HANDLING, PURIFICATION, AND STORAGE EQUIPMENT

NOT USED

DIVISION 44 - POLLUTION CONTROL EQUIPMENT

NOT USED

DIVISION 45 - INDUSTRY-SPECIFIC MANUFACTURING EQUIPMENT

NOT USED

DIVISION 46 - RESERVED

NOT USED

DIVISION 47 - RESERVED

NOT USED

DIVISION 48 - ELECTRICAL POWER GENERATION

NOT USED

DIVISION 49 - RESERVED

NOT USED

END OF DOCUMENT 000110

This page intentionally left blank.

DOCUMENT 000125 - APPLICABLE CODES AND STANDARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes applicable codes.

1.3 APPLICABLE CODES

A. Applicable codes include, but are not limited to, the following:

1. 2016 "California Administrative Code", California Code of Regulations, Title 24, Part 1.
2. 2016 "California Building Code" (CBC), California Code of Regulations, Title 24, Part 2, Volumes 1 and 2 (Based on the 2015 "International Building Code").
3. 2016 "California Electrical Code" (CEC), California Code of Regulations, Title 24, Part 3 (Based on the 2014 "National Electrical Code").
4. 2016 "California Mechanical Code" (CMC), California Code of Regulations, Title 24, Part 4 (Based on the 2015 "Uniform Mechanical Code").
5. 2016 "California Plumbing Code" (CPC), California Code of Regulations, Title 24, Part 5 (Based on the 2015 "Uniform Plumbing Code").
6. 2016 "California Energy Code" (CEC), California Code of Regulations, Title 24, Part 6.
7. 2016 "California Fire Code" (CFC), California Code of Regulations, Title 24, Part 9 (Based on the 2015 "International Fire Code").
8. 2016 "California Green Building Standards Code" (CALGreen), California Code of Regulations, Title 24, Part 11.
9. 2016 "California Referenced Standards Code", California Code of Regulations, Title 24, Part 12.
10. "Public Safety", Title 19 California Code of Regulations, State Fire Marshal Regulations.
11. 2016 "Elevator Safety Orders", California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6.

1.4 APPLICABLE STANDARDS

A. Applicable standards include, but are not limited to, the following:

1. 2010 ADA Standards for Accessible Design.
2. 2013 NFPA 10 "Standard for Portable Fire Extinguishers".
3. 2016 NFPA 13 "Standard for the Installation of Sprinkler Systems".
4. 2016 NFPA 14 "Standard for the Installation of Standpipe and Hose Systems", (with California Amendments).
5. 2013 NFPA 17A "Standard for Wet Chemical Extinguishing Systems".

6. 2016 NFPA 20 "Standard for the Installation of Stationary Pumps for Fire Protection".
7. 2016 NFPA 24 "Standard for the Installation of Private Fire Service Mains and Their Appurtenances", (with California Amendments).
8. 2016 NFPA 72 "National Fire Alarm and Signaling Code", (with California Amendments).
9. 2016 NFPA 80 "Standard for Fire Doors and Other Opening Protectives".
10. 2015 NFPA 2001 "Standard on Clean Agent Fire Extinguishing Systems"
11. Reference Code Section for NFPA Standards: 2016 "California Building Code" (SFM), Chapter 35. See Chapter 35 for California Amendments to NFPA Standards.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF DOCUMENT 000125

TABLE OF CONTENTS

NOTICE CALLING FOR BIDS

DISTRICT	**COMPTON COMMUNITY COLLEGE DISTRICT**
PROJECT NAME	**Instructional Building #2** **Bid No. RFQ CCC-055**
MANDATORY JOB WALK	**Thursday, September 5, 2019 at 2:00PM** **Meet at the flagpole by the Administration Building**
LATEST TIME/DATE FOR SUBMISSION OF BID PROPOSALS	**2:00 P.M.** **Thursday, October 03, 2019**
LOCATION FOR SUBMISSION OF BID PROPOSALS	**COMPTON COMMUNITY COLLEGE DISTRICT** **1111 East Artesia Boulevard** **Compton, CA 90221** **Building: C-Row, Business Services Office** **Office/Room: C-34**
LOCATION FOR OBTAINING BID AND CONTRACT DOCUMENTS	**COMPTON COMMUNITY COLLEGE DISTRICT** **Website:** http://www.compton.edu/district/administration/businessadmin/Bid_Proposal_Requests.aspx

NOTICE IS HEREBY GIVEN that the COMPTON COMMUNITY COLLEGE DISTRICT (District), acting by and through its Board of Trustees, will receive up to, but not later than the above-stated date and time, sealed Bid Proposals for the Contract for the Work generally described as **Instructional Building 2, Bid No. CCC-055.**

1. Submittal of Bid Proposals. All Bid Proposals must be submitted on forms furnished by the District prior to the latest time for submission of Bid Proposals and the District's public opening and reading of Bid Proposals.

2. Bid and Contract Documents. The Bid and Contract Documents will be available electronically, beginning on Wednesday, August 28, 2019 on the District's website: http://www.compton.edu/district/administration/businessadmin/Bid_Proposal_Requests.aspx

3. While the Bid and Contract Documents may be available through other Planrooms or sites, the District does not guarantee the authenticity or completeness of the Bid and Contract Documents obtained from such other Planrooms or sites. Bidders shall be solely responsible for reviewing the District's website and downloading any and all Project Documents and Addenda prior to bidding.

4. Documents Accompanying Bid Proposal. Each Bid Proposal shall be submitted with the following documents. All information or responses of a Bidder in its Bid Proposal and other documents accompanying the Bid Proposal shall be complete, accurate and true; incomplete, inaccurate or untrue responses or information provided therein by a Bidder shall be grounds for the District to reject such Bidder's Bid Proposal for non-responsiveness.

Bid Security	Statement of Qualifications
Subcontractors List	DIR Registration Verification
Non-Collusion Declaration	Bidder's Injury and Illness Prevention Program (IIPP)

5. Prevailing Wage Rates. Pursuant to California Labor Code §1773, the Director of the Department of Industrial Relations of the State of California has determined the generally prevailing rates of wages in the locality in which the Work is to be performed. Copies of these determinations, entitled "PREVAILING WAGE SCALE" are available for review on the internet at http://www.dir.ca.gov/dlsr/statistics_research.html. The Contractor awarded the Contract for the Work shall post a copy of all applicable prevailing wage rates for the Work at conspicuous locations at the Site of the Work. The Contractor and all Subcontractors performing any portion of the Work shall pay not less than the applicable prevailing wage rate for the classification of labor provide by their respective workers in prosecution and execution of the Work. During the Work and pursuant to Labor Code §1771.4(a)(4), the Department of Industrial Relations shall monitor compliance with prevailing wage rate requirements and enforce the Contractor's prevailing wage rate obligations.

6. Contractors' License Classification. Bidders must possess the following classification(s) of California Contractors License at the time that the Bid Proposal is submitted and at time the Contract for the Work is awarded: B - General Building. The Bid Proposal of a Bidder who does not possess a valid and in good standing Contractors' License in the classification(s) set forth above will be rejected for non-responsiveness. Any Bidder not duly and properly licensed is subject to all penalties imposed by law. No payment shall be made for the Work unless and until the Registrar of Contractors verifies to the District that the Bidder awarded the Contract is properly and duly licensed for the Work.

7. Bidder and Subcontractors DIR Registered Contractor Status. Pursuant to and in accordance with Labor Code §1771.1, each Bidder must be a DIR Registered Contractor when submitting a Bid Proposal. The Bid Proposal of a Bidder who is not a DIR Registered Contractor when the Bid Proposal is submitted will be rejected for non-responsiveness. All Subcontractors identified in a Bidder's Subcontractors' List must be DIR Registered contractors at the time the Bid Proposal is submitted.

8. Contract Time. Substantial Completion of the Work shall be achieved within the time set forth in Contract Documents after the date for commencement of the Work established in the Notice to Proceed issued by the District. Failure to achieve Substantial Completion within the Contract Time will result in the assessment of Liquidated Damages as set forth in the Contract.

9. Bid Security. Each Bid Proposal shall be accompanied by Bid Security in an amount equal to TEN PERCENT (10%) of the maximum amount of the Bid Proposal, inclusive of any additive Alternate Bid Item(s). Failure of any Bid Proposal to be accompanied by Bid Security in the form and in the amount required shall render such Bid Proposal to be non-responsive and rejected by the District.

10. Payment Bond; Performance Bond. Prior to commencement of the Work, the Bidder awarded the Contract shall deliver to the District a Payment Bond and a Performance Bond issued by a California Admitted Surety in the form and content included in the Contract Documents each of which shall be in a penal sum equal to One Hundred Percent (100%) of the Contract Price.

11. Pre-Bid Inquiries. Bidders may submit pre-bid inquiries or clarification requests **using the pre-bid request for information form included in the Contract Documents as Section 00 43 24**. Bidders are solely and exclusively responsible for submitting such inquiries or clarification requests not less than Fourteen (14) days prior to the scheduled closing date for the receipt of Bid Proposals. The District will not respond to any bidder inquiries or clarification requests, unless such inquiries or clarification requests are submitted timely to Carol Kober at: ckober@pcm3.com. DO NOT send any pre-bid inquiries or clarification requests to the District.

12. No Withdrawal of Bid Proposals. Bid Proposals shall not be withdrawn by any Bidder for a period of ninety (90) days after the opening of Bid Proposals. During this time, all Bidders shall guarantee prices quoted in their respective Bid Proposals.

13. Job-Walk. The District will conduct a MandatoryJob Walk on Thursday, September 05, 2019 , beginning at 2:00 PM. Bidders are to meet at the Flag Pole south of the Administration Building at the Compton CCD Campus for the Job Walk. Parking permit is $3.00 and permits are available at parking kiosks in the parking lots. Please plan accordingly. If the Job Walk is mandatory, the Bid Proposal submitted by a Bidder whose representative(s) did not attend the entirety of the Mandatory Job Walk will be rejected by the District as being non-responsive.

14. Waiver of Irregularities**.** The District reserves the right to reject any or all Bid Proposals or to waive any irregularities or informalities in any Bid Proposal or in the bidding.

15. Owner Controlled Insurance Program ("OCIP"). The District has elected to implement an Owner Controlled Insurance Program ("OCIP") under the Statewide Educational Wrap Up Program ("SEWUP") in connection with construction of the Project. The SEWUP Joint Powers Authority ("JPA") will be providing the OCIP on behalf of the District. Subject to meeting underwriter and other requirements of the OCIP, the JPA will provide Workers' Compensation, Employer's Liability, General Liability, Contractors' Pollution Liability, and Builders Risk insurance for the Contractor (along with Enrolled Subcontractors) and other designated parties for Work performed at the Site. The District will pay all premiums associated with the OCIP, unless otherwise in the Contract Documents. Insurance coverage provided under the OCIP is limited in scope and specific to Work performed after the inception date of enrollment into the OCIP. Labor and operations relating to the Work conducted away from the Site ("Offsite Operations") are not covered by the OCIP; the Contractor and Subcontractors shall obtain insurance for Offsite Operations as required by the Contract Documents. In addition to any insurance provided by the District through the OCIP, the Contractor and Subcontractors are responsible for obtaining insurance coverages required by this Addendum. The District encourages Bidders to carefully review provisions of the Contract Documents relating to the OCIP and other insurance required to be maintained by the successful Bidder and to discuss insurance requirements with their insurance agents, brokers or insurance consultants to assure that all required insurance policies and minimum coverage amounts are maintained during the Work.

16. Award of Contract. The Contract for the Work, if awarded, will be by action of the District's Board of Trustees to the responsible Bidder submitting the lowest priced responsive Bid Proposal. If the Bid Proposal requires Bidders to propose prices for Alternate Bid Items, the District's selection of Alternate Bid Items, if any, for determination of the lowest priced Bid Proposal and for inclusion in the scope of the Contract to be awarded shall be in accordance with the Instructions for Bidders.

Architect/Engineer Project Cost Estimate: $20 Million

Advertisement publication dates:
Wednesday, August 28, 2019 and Wednesday, September 04, 2019.

[END OF SECTION]

INSTRUCTIONS FOR BIDDERS

1. Preparation and Submittal of Bid Proposal.
   1.1. Bid Proposal Preparation. All information required by the bid forms must be completely and accurately provided. Numbers shall be stated in both words and figures where so indicated in the bid forms; conflicts between a number stated in words and in figures are governed by the words. Partially completed Bid Proposals or Bid Proposals submitted on other than the bid forms included herein are non-responsive and will be rejected. Bid Proposals not conforming to these Instructions for Bidders and the Notice to Contractors Calling for Bids ("Call for Bids") may be deemed non-responsive and rejected.
   1.2. Bid Proposal Submittal. Bid Proposals shall be submitted at the place designated in the Call for Bids in sealed envelopes bearing on the outside the Bidder's name and address along with an identification of the Work for which the Bid Proposal is submitted. Bidders are solely responsible for timely submission of Bid Proposals to the District at the place designated in the Call for Bids.
   1.3. Date and Time of Bid Proposal Submittal. A Bid Proposal is submitted only if the outer envelope containing the Bid Proposal is marked with the Project title and is received by a District Purchasing Department representative for logging-in at (or before) the latest date and time for submittal of Bid Proposals.
2. Bid Security. Each Bid Proposal shall be accompanied by Bid Security in the form of: (i) cash, (ii) a certified or cashier's check made payable to the District or (iii) a Bid Bond, in the form and content attached hereto, in favor of the District executed by the Bidder as a principal and a Surety as surety (the "Bid Security") in an amount equal to Ten Percent (10%) of the Bid Proposal amount, inclusive of the price(s) proposed for additive Alternate Bid Items, if any. A Bid Proposal submitted without the required Bid Security is non-responsive and will be rejected. If the Bid Security is in the form of a Bid Bond, the Bidder's Bid Proposal shall be deemed responsive only if the Bid Bond is in the form and content included herein, duly completed and executed (with notary acknowledgements) on behalf of the Bidder and Surety, and the Surety is an Admitted Surety Insurer under Code of Civil Procedure §995.120.

3. Documents Accompanying Bid Proposal; Signatures. Documents which must be submitted with each Bid Proposal are identified in the Call for Bids. Any document submitted with a Bid Proposal which is not complete, accurate and executed, as required by each document, will result in the Bid Proposal being deemed non-responsive.

4. Bidder Modifications; Withdrawal or Modification of Submitted Bid Proposal.
   4.1. Bidder Modifications to Bid Forms Prohibited. Modifications by a Bidder to the bid forms which are not specifically called for or permitted may result in the Bidder's Bid Proposal being deemed non-responsive and rejected.
   4.2. Erasures; Inconsistent or Illegible Bid Proposals. Bid Proposals must not contain any erasures, interlineations or other corrections unless the same are suitably authenticated by affixing in the margin immediately opposite such erasure, interlineations or correction the surname(s) of the person(s) signing the Bid Proposal. Any Bid Proposal not conforming to the foregoing may be deemed by the District to be non-responsive. If any Bid Proposal or portions thereof, is determined by the District to be illegible, ambiguous or inconsistent, whether by virtue of any erasures, interlineations, corrections or otherwise, the District may reject such a Bid Proposal as being non-responsive.
   4.3. Withdrawal or Modification of Submitted Bid Proposal. A Bidder may not withdraw or modify a Bid Proposal submitted to the District except in strict conformity to the following. Bid Proposals may be withdrawn or modified only if: (i) the Bidder submitting the Bid Proposal submits a request for withdrawal or modification in writing to the District; and (ii) the written withdrawal or modification request is actually received by the District prior to the latest date/time for submittal of Bid Proposals. Requests for withdrawal of a Bid Proposal after the public opening of Bid

Proposals pursuant to Public Contract Code §5100, et seq. will be considered only if in strict conformity with requirements of Public Contract Code §5100, et seq.

5. Examination of Site and Contract Documents. Each Bidder shall, at its sole cost and expense, inspect the Site and become fully acquainted with the Contract Documents and conditions affecting the Work. Failure of a Bidder to receive or examine any of the Contract Documents or to inspect the Site shall not relieve such Bidder from any obligation with respect to the Bid Proposal, or the Work required under the Contract Documents. The District assumes no responsibility or liability to any Bidder for, nor shall the District be bound by, any understandings, representations or agreements of the District's agents, employees or officers concerning the Contract Documents or the Work made prior to execution of the Contract which are not in the form of Bid Addenda duly issued by the District. The submission of a Bid Proposal shall be deemed prima facie evidence of the Bidder's full compliance with the requirements of this section.

6. Agreement and Bonds. The Agreement which the successful Bidder, as Contractor, will be required to execute along with the forms Payment Bond, Performance Bond and other documents and instruments which are required to be furnished are included in the Contract Documents and shall be carefully examined by the Bidder. The required number of executed copies of the Agreement and the form and content of the Performance Bond and the Payment Bond and other documents or instruments required at the time of execution of the Agreement are specified in the Contract Documents.

7. Pre-Bid Questions; Contract Document Interpretation and Modifications.
   7.1. Bidder Pre-Bid Questions. Any Bidder in doubt as to the true meaning of any part of the Contract Documents; finds discrepancies, errors or omissions therein; or finds variances in any of the Contract Documents with the Laws ("Pre-Bid Questions"), shall submit a request for clarification, interpretation or correction thereof using the form of Pre-Bid Request for Information included with the Contract Documents. Bidders are solely and exclusively responsible for submitting Pre-Bid Questions no later than the time/date designated in the Call for Bids. Responses to Pre-Bid Questions will be by written addendum issued by, or on behalf of, the District. A copy of any such addendum will be mailed or otherwise delivered to each Bidder receiving a set of the Contract Documents. Failure to request interpretation or clarification of any portion of the Contract Documents pursuant to the foregoing is a waiver of any discrepancy, defect or conflict therein.
   7.2. No Oral Interpretations. No person is authorized to: (i) render an oral interpretation or correction of any portion of the Contract Documents; or (ii) provide oral responses to Pre-Bid Questions. No Bidder is authorized to rely on any such oral interpretation, correction or response.

8. District's Right to Modify Contract Documents. Before the public opening and reading of Bid Proposals, the District may modify the Work, the Contract Documents, or any portion(s) thereof by the issuance of written addenda disseminated to all Bidders who have obtained a copy of the Specifications, Drawings and Contract Documents pursuant to the Call for Bids. If the District issues any addenda during the bidding, the failure of any Bidder to acknowledge such addenda in its Bid Proposal will render the Bid Proposal non-responsive and rejected.

9. Bidder's Assumptions. The District is not responsible for any assumptions made or used by the Bidder in calculating its Bid Proposal Amount including, without limitation, assumptions regarding costs of labor, materials, equipment or substitutions/alternatives for any material, equipment, product, item or system incorporated into or forming a part of the Work which have not been previously expressly approved and accepted by the District. The successful Bidder, upon award of the Contract by the District, if any, will be required to complete the Work for the amount bid in the Bid Proposal within the Contract Time and in accordance with the Contract Documents.

10. Bidders Interested in More Than One Bid Proposal; Non-Collusion Declaration. No person, firm, corporation or other entity shall submit or be interested in more than one Bid Proposal for the same Work; provided, however, that a person, firm or corporation that has submitted a sub-proposal to a Bidder or who has quoted prices for materials to a Bidder is not disqualified from submitting a sub-proposal, quoting prices to other Bidders or submitting a Bid Proposal for the proposed Work to the District. The form of Non-Collusion Declaration included in the Contract Documents must be completed and duly executed on behalf of the Bidder; failure of a Bidder to submit a completed and executed Non-Collusion Declaration with its Bid Proposal will render the Bid Proposal non-responsive.

11. Determination of Lowest Responsive Responsible Bid/Award of Contract.

11.1. Waiver of Irregularities or Informalities. The District reserves the right to reject any and all Bid Proposals or to waive any irregularities or informalities in any Bid Proposal or in the bidding.

11.2. Award to Lowest Responsive Responsible Bidder. The award of the Contract, if made by the District through action of its Board of Trustees and subsequent State Chancellors Office/Department of Finance Approval, will be to the responsible Bidder submitting the lowest priced responsive Bid Proposal on the basis of the Base Bid Proposal.

11.3. Award of Contract. If the Bidder submitting this Bid Proposal is awarded the Contract, the undersigned will execute and deliver to the District the Agreement in the form attached hereto within Five (5) calendar days after notification of award of the Contract. Concurrently with delivery of the executed Agreement to the District, the Bidder awarded the Contract shall deliver to the District: (i) Certificates of Insurance evidencing all insurance coverages the Bidder and its Subcontractors are required to obtain under the Contract Documents; (ii) Performance Bond; (iii) Labor and Material Payment Bond; (iv) Certificate of Workers' Compensation Insurance; (v) Drug-Free Workplace Certificate; Failure of the Bidder awarded the Contract to strictly comply with the preceding may result in the District's rescinding award of the Contract and/or forfeiture of the Bidder's Bid Security. In such event, the District may, in its sole and exclusive discretion elect to award the Contract to the responsible Bidder submitting the next lowest priced Bid Proposal or to reject all Bid Proposals.

11.4. Alternate Bid Items Not Included in Award of Contract. Bidders are referred to the provisions of the Contract Documents permitting the District, during performance of the Work, to add or delete from the scope of the Work any or all of the Alternate Bid Items with the cost or credit of the same being the amount(s) set forth by in the Alternate Bid Items Bid on the Proposal.

11.5. Responsive Bid Proposal. A responsive Bid Proposal shall mean a Bid Proposal which conforms to and complies with requirements of the Bid and Contract Documents. A Bid Proposal that does not conform to material bidding requirements, as reasonably determined by the District, is subject to rejection for non-responsiveness.

11.6. Hearing re Rejected Bid. If a Bidder's bid is rejected by the District, that Bidder may request a hearing on that rejection: (i) if the District issues a notice of intent to award a contract to a Bidder whose bid is higher than the bid that was rejected; and (ii) the Bidder strictly complies with the following provisions relating to time limitations for requesting a hearing. To be considered by the District, such a request for a hearing must be in writing and submitted to the District's Vice President, Administrative Services, Room C-34, 1111 E. Artesia Blvd., Compton, CA 90221. and must be actually received by the District's Vice President, Administrative Services by the earlier of: (i) 5:00 PM one (1) business day after the District's notice to the Bidder of the District's rejection of the Bidder's Bid Proposal; or (ii) 5:00 PM one (1) business

day after the date of the District's notice of intent to award a contract. If a Bidder does not request a hearing in strict conformity with the foregoing, such Bidder shall be deemed to have knowingly and voluntarily waive rights to a hearing. The District will grant or deny such request for a hearing based on the holding of the California Court of Appeal in *Great West Contractors, Inc. v. Irvine Unified School District* (2010) 187 Cal. App. 4th 1425. If a Bidder timely requests a hearing pursuant to the foregoing, the District will notify such Bidder in writing by 5:00 PM two (2) business days after the date of the Bidder's request for hearing is submitted of the District grant or denial of such a hearing. If the District grants a hearing, the District will schedule the hearing for a date not less than three (3) business days after the date of such notice to the Bidder requesting a hearing. If the District holds such a hearing, any Bidder may at its own expense: i) be represented at the hearing by legal counsel; ii) record the proceedings by court reporter; iii) present oral and/or written statements and/or other documents.

11.7. Responsible Bidder.

11.7.1. Bidder Capacity. Factors affecting the Bidder's capacity to perform and complete the Work will be assessed, including: (i) Bidder's access to labor, materials and other resources necessary to complete the Work; (ii) Bidder's ability to complete the Work within the time established for completion of the Work, or portions thereof; and (iii) Bidder's ability to complete warranty obligations.

11.7.2. Bidder Character, Integrity. Factors reflecting the character and integrity of the Bidder, including: (i) other public agency finding/determination, within the past five (5) years, that the Bidder is not responsible; (ii) currently debarred from bidding public works projects or debarment from bidding within past five (5) years; and (iii) false claims liability within the past five (5) years under local, state or federal laws.

11.7.3. Bidder Financial Capability. Factors considered include: (i) sufficiency of the Bidder's financial resources; (ii) whether the Bidder is current in payment of debts and performance of other financial obligations; and (iii) bankruptcy or insolvency proceedings have been instituted within the past five (5) years.

11.7.4. Bidder Prior Performance. The Bidder's prior performance on prior public works contracts, including without limitation: (i) cost overruns; (ii) compliance with general conditions and other contractual requirements, including schedule development, schedule updates and coordination of labor, material/equipment procurements and subcontractors; (iii) completion within allocated time; (iv) submittal of unsubstantiated, unsupported or excessive cost proposals, claims or contract adjustment requests; (iv) completion of a project by a surety; (vi) owner's exercise of default remedies; and (vii) finding or determination by any public agency that the Bidder is not a responsible bidder.

11.7.5. Safety. Factors include: (i) findings of serious or willful safety violations of safety laws, regulations or requirements by any local, state or federal agency within the past five (5) years; (ii) adequacy and implementation of safety plans, programs for on-site and off-site construction and construction related activities; and (iii) Workers Compensation Insurance EMR rating exceeding 1.25.

12. Subcontractors.

12.1. Designation of Subcontractors; Subcontractors List. In accordance with Public Contract Code §4104, the Subletting and Subcontracting Fair Practices Act (California Public Contract Code §§4100 et seq.), each Bidder shall submit, on the form of Subcontractors List included with the Contract Documents, a list of its proposed Subcontractors for the proposed Work, including any Alternate Bid Items, who will perform/provide portions of the Work valued at or more than one-half (1/2) of one percent (1%) of the amount proposed by the Bidder for the Work. The Subcontractors List consists of five (5) columns, each of which requires the Bidder's disclosure of information relating to each listed Subcontractor as follows:

Column A Name of Subcontractor

Column B Subcontractor's Address
Column C Subcontractor's Portion of the Work
Column D Subcontractor's California Contractors' License
Column E Subcontractor DIR Registration

All columns of the Subcontractors List must be completed by the Bidder for each Subcontractor identified by the Bidder in its Subcontractors List submitted concurrently with the Bidder's Bid Proposal. Failure of a Bidder to comply with the foregoing may render the Bidder's Bid Proposal non-responsive and rejected.

12.2. Work of Subcontractors. All Bidders are referred to the Contract Documents and the notation therein that all Contract Documents are intended to be complimentary and that the organization or arrangements of the Specifications and Drawings shall not limit the extent of the Work of the Contract Documents. Accordingly, all Bidders are encouraged to disseminate all of the Specifications, Drawings and other Contract Documents to all persons or entities submitting sub-bids to the Bidder. The omission of any portion or item of Work from the Bid Proposal or from the sub-bidders' sub-bids which is/are necessary to produce the intended results and/or which are reasonably inerrable from the Contract Documents is not a basis for adjustment of the Contract Price or the Contract Time. Dissemination of the Contract Documents to sub-bidders and dissemination of addenda issued during the bidding process is solely the responsibility of each Bidder.

12.3. Subcontractor Bonds. Pursuant to California Public Contract Code §4108, if a Bidder requires a bond or bonds of its Subcontractor(s), whether the expense of procuring such bond or bonds are to be borne by the Bidder or the Subcontractor(s), such requirements shall be specified in the Bidder's written or published request for sub-bids. Failure of the Bidder to comply with these requirements shall preclude the Bidder from imposing bonding requirements upon its Subcontractor(s) or rejection of a Subcontractor's bid under California Public Contract Code §4108(b).

13. Workers' Compensation Insurance. Pursuant to California Labor Code § 3700, the successful Bidder shall secure Workers' Compensation Insurance for its employees engaged in the Work of the Contract. The successful Bidder shall execute and deliver to the District the form of Workers Compensation Certification included in the Contract Documents concurrently with such Bidder's delivery of the executed Agreement to the District.

14. Bid Security Return. The Bid Security of the Bidders submitting the three lowest priced Bid Proposals, the number being solely at the discretion of the District, will be held by the District for ten (10) days after the period for which Bid Proposals must be held open (which is set forth in the Call for Bids) or until posting by the successful Bidder(s) of the bonds, certificates of insurance required and return of executed copies of the Agreement, whichever first occurs, at which time the Bid Security of such other Bidders will be returned to them.

15. Forfeiture of Bid Security. If the Bidder awarded the Contract fails or refuses to execute the Agreement within Five (5) calendar days from the date of receiving notification that it is the Bidder to whom the Contract has been awarded, the District may declare the Bidder's Bid Security forfeited as damages caused by the failure of the Bidder to enter into the Contract and may thereupon award the Contract for the Work to the responsible Bidder submitting the next lowest Bid Proposal or may call for new bids, in its sole and exclusive discretion.

16. Contractors' License. No Bid Proposal will be considered from a Bidder who, at the time Bid Proposals are opened, is not licensed to perform the Work of the Contract Documents, in accordance with the Contractors' License Law, California Business & Professions Code §§7000, *et seq*. This requirement is not a mere formality and will not be waived by the District or its Board of

Trustees. The required California Contractors' License classification(s) for the Work is set forth in the Call for Bids.

17. Non-Discriminatory Employment Practices. It is the policy of the District that there be no discrimination against any prospective or active employee engaged in the Work because of race, color, ancestry, national origin, religious creed, sex, age, marital status or other legally protected classification. All Bidders agree to comply with the District's non-discrimination policy and all applicable Federal and California anti-discrimination laws including but not limited to the California Fair Employment & Housing Act beginning with California Government Code §§ 12940, *et seq*. and California Labor Code § 1735. In addition, all Bidders agree to require like compliance by any Subcontractor employed by them on the Work of the Contract.

18. Sexual Harassment. It is the policy of the District to ensure that everyone complies with Education Code, Government Code, Title V of the Administrative Code, and all other related statues related to the prevention of Sexual Harassment. All Bidders agree to comply with the District's Sexual Harassment Prevention Program and all applicable Federal and California laws including but not limited to the California Fair Employment & Housing Act commencing with California Government Code §12950, *et seq.* In addition, all Bidders agree to require like compliance by any Subcontractor employed by them on the Work of the Contract.

19. Bidder's Qualifications. Each Bidder shall submit with its Bid Proposal the form of Statement of Bidder's Qualifications, which is included within the Contract Documents. All information required by Statement of Bidder's Qualifications shall be completely and fully provided. Any Bid Proposal not accompanied by the Statement of Bidder's Qualifications completed with all information required and bearing the signature of the Bidder's duly authorized representative under penalty of perjury will render the Bid Proposal non-responsive and rejected. If the District determines that any information provided by a Bidder in the Statement of Bidder's Qualifications is false or misleading, or is incomplete so as to be false or misleading, the District may reject the Bid Proposal submitted by such Bidder as being non-responsive. If any response to the "Essential Requirements" section of the Statement of Qualifications is a "not qualified" response, the Bidder's Bid Proposal will be rejected for failure of the Bidder to meet minimum qualifications for the Work.

20. Job-Walk.

    20.1. Mandatory and Non-Mandatory Job Walk. The District will conduct a Job-Walk at the time(s) and place(s) designated in the Call for Bids. If attendance at the Job Walk is indicated in the Call for Bids as being mandatory, the failure of any Bidder to have its authorized representative present at the entirety of the Job-Walk will render the Bid Proposal of such Bidder to be non-responsive. The attendance by representatives of the Bidder's Subcontractors at a Mandatory Job Walk without attendance by a representative of the Bidder shall not be sufficient to meet the Bidder's obligations hereunder and will render the Bid Proposal of such Bidder to be non-responsive. If a Job Walk is indicated in the Call for Bids as being Non-Mandatory, the Bid Proposal of a Bidder who does not attend the Non-Mandatory Job Walk will not be rejected for non-responsiveness. Notwithstanding the non-compulsory attendance of Bidders at a Non-Mandatory Job Walk, all Bidders are encouraged to attend Non-Mandatory Job Walks.

    20.2. District Additional Job Walk. The District may, in its sole and exclusive discretion, elect to conduct one or more Job-Walk(s) in addition to that set forth in the Call for Bids, in which event the District shall notify all Bidders who have theretofore obtained the Contract Documents pursuant to the Call for Bids of any such additional Job-Walk. If the District elects to conduct any Job-Walk in addition to that set forth in the Call for Bids, the District shall, in its notice of any such additional Job-Walk(s), indicate whether Bidders' attendance at such additional Job-Walk(s) is/are mandatory.

20.3. Bidder Requested Additional Job Walk. Any Bidder who has obtained the Bid Documents pursuant to the Call for Bids may, by written request to the District, request an additional Job Walk if the District has designated a Job Walk in the Call for Bids or a Job Walk if the District has not designated a Job Walk in the Call for Bids. The District may, in its sole and exclusive discretion, conduct such requested Job-Walk taking into consideration factors such as the time remaining prior to the scheduled opening of Bid Proposals. Any such requested Job Walk will be conducted only upon the requesting Bidder's agreement to reimburse the District for the actual and/or reasonable costs for the District's staff and its agents and representatives in arranging for and conducting such additional Job-Walk.

21. Public Records. Bid Proposals and other documents responding to the Call for Bids become the exclusive property of the District upon submittal to the District. At such time as the District issues the Notice of Intent to award the Contract pursuant to these Instructions for Bidders, all Bid Proposals and other documents submitted in response to the Call for Bids (including the Statement of Qualifications) become a matter of public record and shall be thereupon be considered public records, materials deemed to be Trade Secrets (as defined in California Civil Code § 3426.1), and Financial Statements if submitted with a Bidder's Bid Proposal. A Bidder that indiscriminately marks all or most of its Bid Proposal as exempt from disclosure as a public record, whether by the notations of "Trade Secret," "Confidential," "Proprietary," or other similar notations, may result in, or render, the Bid Proposal non-responsive and rejected. The District is not liable or responsible for the disclosure of such records, including those exempt from disclosure if disclosure is deemed required by law, by an order of Court, or which occurs through inadvertence, mistake or negligence on the part of the District or its officers, employees or agents. At such time as Bid Proposals are deemed a matter of public record, pursuant to the above, any Bidder or other party shall be afforded access for inspection and/or copying of such Bid Proposals, by request made to the District in conformity with the California Access to Public Records Act, California Government Code §§6250, et. seq. If the District is required to defend or otherwise respond to any action or proceeding wherein request is made for the disclosure of the contents of any portion of a Bid Proposal deemed exempt from disclosure hereunder, the Bidder submitting the materials sought by such action or proceeding agrees to defend, indemnify and hold harmless the District in any action or proceeding from and against any liability, including without limitation attorneys' fees arising therefrom. The party submitting materials sought by any other party shall be solely responsible for the cost and defense in any action or proceeding seeking to compel disclosure of such materials; the District's sole involvement in any such action shall be that of a stakeholder, retaining the requested materials until otherwise ordered by a court of competent jurisdiction.

22. Drug Free Workplace Certificate. In accordance with California Government Code §§ 8350 et seq., the Drug Free Workplace Act of 1990, the successful Bidder will be required to execute a Drug Free Workplace Certificate concurrently with execution of the Agreement. The successful Bidder will be required to implement and take the affirmative measures outlined in the Drug Free Workplace Certificate and in California Government Code §§8350 et seq. Failure of the successful Bidder to comply with the measures outlined in the Drug Free Workplace Certificate and in California Government Code §§ 8350 et seq. may result in penalties, including without limitation, the termination of the Agreement, the suspension of any payment of the Contract Price otherwise due under the Contract Documents and/or debarment of the successful Bidder.

23. Compliance with Immigration Reform and Control Act of 1986. The Bidder is solely and exclusively responsible for employment of individuals for the Work of the Contract in conformity with the Immigration Reform and Control Act of 1986, 8 USC §§1101, *et seq*. (the "IRCA"); the successful Bidder shall also require that any person or entity employing labor in connection with any of the Work of the Contract shall so similarly comply with the IRCA.

24. Notice of Intent to Award Contract. Following the public opening and reading of Bid Proposals, the District will issue a Notice of Intent to Award the Contract, identifying the Bidder to whom the District intends to award the Contract and the date/time/place of the District's Board of Trustees meeting at which award of the Contract will be considered.

25. Substitute Security. The successful Bidder may request substitution of eligible and equivalent securities for any monies withheld by the District to ensure the Contractor's performance under the Contract pursuant to California Public Contract Code §22300. The foregoing notwithstanding, the Bidder to whom the Contract is awarded shall make its written request to the District for substitute security not later than the date of the submission of the first Application for Progress Payment; failure to request substitute security on or prior to such date shall be deemed a waiver of rights under Public Contract Code §22300.

26. Bid Protest.
    26.1. Submittal of Bid Protest. Any Bidder submitting a Bid Proposal to the District may file a protest of the District's intent to award the Contract provided that all of the following are complied with: (i) the bid protest is in writing; (ii) the bid protest is filed and received by the District's Vice President, Administrative Services, not more than five (5) calendar days after the date of issuance of the District's Notice of Intent to Award the Contract; and (iii) the written bid protest sets forth, in detail, all grounds for the bid protest, including without limitation all facts, supporting documentation, legal authorities and argument in support of the grounds for the bid protest; any matters not set forth in the written bid protest shall be deemed waived. All factual contentions must be supported by competent, admissible and creditable evidence. Any bid protest not conforming to the foregoing shall be rejected by the District as invalid.
    26.2. District Review and Disposition of Bid Protest. Provided that a bid protest is filed in strict conformity with the foregoing, the District's Vice President, Administrative Services, or such individual(s) as may be designated by him/her ("Designee") will review and evaluate the basis of the bid protest. The District's Vice President, Administrative Services, or Designee shall provide the Bidder submitting the bid protest with a written statement concurring with or denying the bid protest ("Bid Protest Response"). The Bid Protest Response is deemed the final action of the District and not subject to appeal or reconsideration by any other employee or officer of the District or the Board of Trustees of the District. The issuance of the Bid Protest Response by the District's Vice President, Administrative Services, or the Designee is an express condition precedent to the institution of any legal or equitable proceedings relative to the bidding process, the District's intent to award the Contract, the District's disposition of any bid protest or the District's decision to reject all Bid Proposals. If any such legal or equitable proceedings are instituted and the District is named as a party thereto, the prevailing party(ies) shall recover from the other party(ies), as costs, all attorneys' fees and costs incurred in connection with any such proceeding, including any appeal arising therefrom. Each Bidder shall acknowledge in the Bid Proposal that the foregoing is a binding attorneys' fee agreement pursuant to Civil Code §1717 and shall be enforceable against the Bidder and the District.

27. OCIP.
    27.1 General. Pursuant to Government Code §4420.5, Labor Code §§6300, et seq. and Title 8 of the California Code of Regulations, the District has implemented an OCIP for the Work as more particularly set forth herein and in the Contract Documents. Pursuant to the OCIP, the District will purchase, provide and maintain for the benefit of the Contractor and its Subcontractors and Sub-Subcontractors, certain insurance for Workers' Compensation/Employer's Liability, General Liability, and Contractor's Pollution Liability as more particularly set forth this Addendum. Notwithstanding insurance coverages provided under the OCIP, the Contractor and its Subcontractors, Sub-Subcontractors and others shall purchase, provide and maintain certain other insurance coverages not provided for under the OCIP as set forth in this Addendum.
    27.2 Bid Proposals Exclusion of Contractor/Subcontractor Insurance Costs. Bidders' pricing

proposals in their Bid Proposals shall be exclusive of premium and other costs of the Bidder and its Subcontractors for the insurance coverages provided under the OCIP. The price proposal in each Bidder's Bid Proposal shall be inclusive of premium and other costs for obtaining and maintaining insurance coverages required by the Contract Documents, but not included in the scope of coverages afforded under the OCIP. Excluded insurance costs shall include self-funded insurance coverages, coverages requiring large deductibles and costs for any coverage above the self-funded or deductible portions.

27.3 Minimum Safety Requirements; Responsive Bid Proposal. In addition to other standards and requirements set forth in the Instructions for Bidders relating to responsive Bid Proposals, a Bid Proposal will be deemed non-responsive and rejected by the District if the Minimum Safety Requirements under the OCIP are not met or exceeded. Pursuant to Government Code §4420.5, the District has established the Minimum Safety Requirements set forth below. The Bidder must meet the Minimum Safety Requirements. The Bid Proposal of a Bidder does not meet the Minimum Safety Requirements will be rejected for non-responsiveness if the Bidder does not meet the following Minimum Safety Requirements:

Workers Compensation Insurance EMR. The Bidder shall have a Workers Compensation Insurance Experience Modification Rating ("EMR") of no more than 1.25 over the last five (5) years.

No Cal-OSHA Violations deemed Serious and Willful. No (zero) violations deemed serious and willful, or repeat under Labor Code §§6300 et seq. within the past five (5) years.

Injury and Illness Prevention Program ("IIPP"). The Bidder and all listed Subcontractors of the Bidder shall have a current IIPP conforming to Labor Code §3201.5 or Labor Code §6401.7.

27.4 District Verification of Compliance with Minimum OCIP Requirements. The District will verify compliance with Minimum OCIP Requirements, including the EMR of Bidders. Any information found to be incorrect or untrue shall render Bidder's Bid Proposal non-responsive.

[End of Section]

BID PROPOSAL
Project: Instructional Building 2, Bid No. CCC-055

Bidder Name	_____	
Bidder Representative(s)	_____ Name and Title _____ Name and Title	
Bidder Representative(s) Contact Information	Email Address(es) _____ _____	Phone/Fax (_____) _____ Telephone (_____) _____ Fax
Bidder Mailing Address	_____ Address _____ City/State/Zip Code	
California Contractors' License	_____ Number _____ Classification(s) and Expiration Date	

1. Bid Proposal.

1.1 Bid Proposal Amount. The undersigned Bidder proposes and agrees to furnish and install the Work including, without limitation, providing and furnishing any and all labor, materials, tools, equipment and services necessary to complete, in a workmanlike manner in accordance with the Contract Documents, all of the Work described as: **CCC-055 Instructional Building 2**, for the sum of:

$ [ ][ ] , [ ][ ][ ] , [ ][ ][ ] . [ ][ ]

_____ Dollars
(in words; printed or typed)

The Bidder confirms that it has checked all of the above figures and understands that neither the District nor any of its agents, employees or representatives shall be responsible for any assumptions, errors or omissions on the part of the undersigned Bidder in preparing and submitting this Bid Proposal. The Bid Proposal Amount includes all Allowances, if any, set forth in Paragraph 1.2 below.

1.2 Allowance. The Bidder and District acknowledge that the Bid Proposal Price set forth above includes an Allowance Amount in the aggregate amount of five hundred thousand Dollars ($500,000.00),

$**500,000.00**	To be used at the District's Discretion

Although included in the Bid Proposal Price, Allowances belong solely to the District and shall be expended only upon written direction by the District, to be granted or denied in its sole discretion. Any Allowance amount not fully consumed shall belong solely to the District

and shall be refunded to the District by a deductive change order. By submitting this Bid Proposal, the Bidder confirms that the Bid Price proposed in Paragraph 1.1 is inclusive of all Allowances.

1.3 Unit Price Items. If applicable, the Bidder's price proposals for Unit Price Items are set forth in the form of a Composite Unit Price Item Proposal included herewith as Attachment A hereto. Although the Unit Price Items may be considered in the determination of the lowest Bid Proposal Amount, Unit Price Items will not form the basis for the District's Contract Price for any Contract awarded. During performance of the Work, the District may elect to add or delete any Unit Price Item set forth in Attachment A. If the District elects to add or delete any Unit Price Item set forth below, the debit or credit for such Unit Price Item shall be in accordance with the Unit Prices set forth in Attachment A hereto.

1.4 Acknowledgment of Bid Addenda. The Bidder confirms that this Bid Proposal incorporates and is inclusive of, all items or other matters contained in Bid Addenda, if any, issued by or on behalf of the District.

_____ **Addenda Nos. _____** received, acknowledged
(initial) and incorporated into this Bid Proposal.

1.5 Alternate Bid Items. The Bidder's proposed pricing for each Alternate Bid Item, if any, are set forth in the accompanying form of Alternate Bid Items Proposal, Attachment B attached hereto. Failure of a Bidder to propose pricing for each Alternate Bid Item set forth in the accompanying Alternate Bid Items Proposal, Attachment B hereto, will result in the Bid Proposal being deemed non-responsive and rejected.

2. Documents Accompanying Bid Proposal. The Bidder has submitted with this Bid Proposal the following:

Bid Security	Statement of Bidder's Qualifications
Subcontractors List	DIR Registration Verification
Non-Collusion Declaration	Contractor Injury and Illness Prevention Program (IIPP)

In addition to the documents identified in Paragraph 2, each Bidder must submit its IIPP; failure to do so will result in rejection of the Bidder's Bid Proposal for non-responsiveness

3. Award of Contract. If the Bidder submitting this Bid Proposal is awarded the Contract, the undersigned will execute and deliver to the District the Agreement in the form attached hereto within Five (5) calendar days after notification of award of the Contract. Concurrently with delivery of the executed Agreement to the District, the Bidder awarded the Contract shall deliver to the District: (i) Certificates of Insurance evidencing all insurance coverages required under the Contract Documents; (ii) Performance Bond; (iii) Labor and Material Payment Bond; (iv) Certificate of Workers' Compensation Insurance; and (v) Drug-Free Workplace Certificate. Failure of the Bidder awarded the Contract to strictly comply with the preceding may result in the District's rescinding award of the Contract and/or forfeiture of the Bidder's Bid Security. In such event, the District may, in its sole and exclusive discretion elect to award the Contract to the responsible Bidder submitting the next lowest priced Bid Proposal or to reject all Bid Proposals.

4. Contractors' License. The Bidder certifies that: (i) it is possesses a valid and in good standing Contractors' License, in the necessary class(es), for performing the Work as set for in the Call for Bids; (ii) that such license shall be in full force and effect throughout the duration of the performance

of the Work; and (iii) that all Subcontractors providing or performing any portion of the Work are properly licensed to perform their respective portions of the Work at the time of submitting this Bid Proposal and will remain so properly licensed at all times during their performance of the Work.

5. Agreement to Bidding Requirements and Attorney's Fees. The undersigned Bidder acknowledges and confirms its receipt, review and agreement with, the contractual requirements set forth in this Bid Proposal and the Contract Documents. By executing this Bid Proposal herein below, the Bidder expressly acknowledges and agrees that if the Bidder institutes any legal or equitable proceedings in connection with this Bid Proposal and the District is named as a party thereto, the prevailing party(ies) shall recover from the other party(ies), as costs, all attorneys' fees and costs incurred in connection with any such proceeding, including any appeal arising therefrom. This provision shall constitute a binding attorneys' fee agreement in accordance with and pursuant to California Civil Code §1717 which shall be enforceable against the Bidder and the District. This attorneys' fee provision shall be solely limited to legal or equitable proceedings arising out of a bid protest or the bidding process and shall not extend to or have any force and effect on the Contract for the Work or to modify the terms of the Contract Documents for the Work.

6. Acknowledgment and Confirmation. The undersigned Bidder acknowledges its receipt, review and understanding of the Drawings, the Specifications and other Contract Documents pertaining to the proposed Work. The undersigned Bidder certifies that the Contract Documents are, in its opinion, adequate, feasible and complete for providing, performing and constructing the Work in a sound and suitable manner for the use specified and intended by the Contract Documents. The undersigned Bidder certifies that it has, or has available, all necessary equipment, personnel, materials, facilities and technical and financial ability to complete the Work for the amount bid herein within the Contract Time and in accordance with the Contract Documents.

By: _____ Date: _____, 20__
(Signature of Bidder's Authorized Officer/ Representative)

_____ _____
(Typed or Printed Name) Title

(FOR PRE-BID USE ONLY)

PRE-BID REQUEST FOR INFORMATION
COMPTON COMMUNITY COLLEGE DISTRICT
Send to ckober@pcm3.com ONLY!

Date of Pre-Bid RFI:_____ Project Name: Instructional Building 2 Project No: CCC-055 Bid Package No.: N/A Bid Package Description: N/A	Bidder Name: _____ _____

Bidder's Pre-Bid Request for Information (Include references to Drawing Sheet Numbers and/or Sections of the Specifications)

_____
_____
_____
_____
_____
_____
_____
_____
_____

Additional pages attached by Bidder: ___ Yes ___ No
Number of additional pages attached by Bidder: _____

Response to Bidder's Pre-Bid Request for Information

_____
_____
_____
_____
_____
_____
_____
_____

Additional pages of RFI Response attached: ___ Yes ___ No
Number of additional RFI Response pages attached: _____

Date of RFI Response:_____

Submitted By: _____ (Bidder Name) _____ (Signature of Bidder's Authorized Employee, Officer or Representative) Submittal Date:_____	Bidder Contact Information: _____ (Bidder Contact Name) _____ (Phone and Fax) _____ (Email Address)

SUBCONTRACTORS LIST

Project **Instructional Building 2**
BID No. CCC-055

Name of Bidder: _____

Authorized Signature: _____

(A) Licensed Name of Subcontractor	(B) Subcontractor Office, Mill or Shop Address	(C) Sub-contractor Trade or Portion of Work	(D) Subcontractor Contractors' License No.	(E) Subcontractor DIR Registration

Attach additional page(s) as required

DIR REGISTRATION VERIFICATION

I am the _____ of _____ ("Bidder")
(Title/Position) (Bidder Name)

submitting the accompanying Bid Proposal for the Work described as **Instructional Building 2, Bid No. CCC-055.**

1. The Bidder is currently registered as a contractor with the Department of Industrial Relations ("DIR").

2. The Bidder's DIR Registration Number is: _____. The expiration date of the Bidder's DIR Registration is June 30, 20___.

3. If the Bidder is awarded the Contract for the Work and the expiration date of the Bidder's DIR Registration will occur: (i) prior to expiration of the Contract Time for the Work; or (ii) prior to the Bidder completing all obligations under the Contract for the Work, the Bidder will take all measures necessary to renew the Bidder's DIR Registration so that there is no lapse in the Bidder's DIR Registration while performing Work under the Contract.

4. The Bidder, if awarded the Contract for the Work will remain a DIR registered contractor for the entire duration of the Work.

5. The Bidder has independently verified that each Subcontractor identified in the Subcontractors List submitted with the Bid Proposal of the Bidder is currently a DIR registered contractor.

6. The Bidder has provided the DIR Registration Number for each subcontractor identified in the Bidder's Subcontractors' List or within twenty-four (24) hours of the opening of Bid Proposals for the Work, the Bidder will provide the District with the DIR Registration Number for each subcontractor identified in the Bidder's Subcontractors List.

7. The Bidder's solicitation of subcontractor bids included notice to prospective subcontractors that: (i) all sub-tier subcontractors must be DIR registered contractors at all times during performance of the Work; and (ii) prospective subcontractors may only solicit sub-bids from and contract with lower-tier subcontractors who are DIR registered contractors.

8. If any of the statements herein are false or omit material facts rendering a statement to be false or misleading, the Bidder's Bid Proposal is subject to rejection for non-responsiveness.

I have personal first hand-knowledge of all of the foregoing. I declare under penalty of perjury under California law that the foregoing is true and correct.

Executed this ____ day of _____, 20___ at _____.
City and State)

_____
(Signature)

_____
(Name, typed or printed)

STATEMENT OF QUALIFICATIONS

1. Bidder Information.

1.1. Contact Information

Mailing Address	_____ Street Address _____ City, State, Zip Code
Physical Location (if different from mailing address)	_____ Street Address _____ City, State, Zip Code
Telephone/Fax	(_____) _____ Telephone (_____) _____ Fax

1.2. Bidder Contacts.

Name	_____
Contact Information	Telephone: (_____)_____ Fax (_____)_____ Email _____

1.3. California Contractors' License.

License Number(s)	_____
License Classification(s)	_____
Responsible Managing Employee; Responsible Managing Officer	_____
Expiration Date(s)	_____

1.4. Bidder Form of Entity.

- ☐ Corporation
- ☐ General Partnership
- ☐ Limited Partnership
- ☐ Limited Liability Company
- ☐ Limited Liability Partnership
- ☐ Joint Venture
- ☐ Sole Proprietorship

[CONTINUED NEXT PAGE]

2. Revenue. Complete the following for the Bidder's construction operations; if any portion of the revenue disclosed is generated by non-construction operations or activities, the Bidder must identify the portion of revenue attributed to construction operations and generally describe business activities of the Bidder that generates non-construction operations related revenue.

Calendar Year/ Fiscal Year	Annual Gross Revenue	Annual Net Revenue	Average Dollar Value of all Contracts	Dollar Value of Largest Contract
2016 (2015/2016)				
2017 (2016/2017)				
2018 (2017/2018)				

3. References.

DSA Project Inspectors			
Firm Name	Address	Telephone No.	Contact Name
Owners (K-12 school districts or community colleges preferred)			
Owner Name	Address	Telephone No.	Contact Name
Architects (K-12 or Community College Projects)			
Architect Firm Name & Architect Firm Contact Name	Address	Telephone No.	Contact Name

[CONTINUED NEXT PAGE]

4. Insurance.

Commercial General Liability Insurance	Insurer: _____ Policy No. _____ Broker _____
Commercial General Liability Insurance Broker	(Contact Name) _____ _____ (Street Address) _____ (City, State & Zip Code) (_____) _____ (_____) _____ Telephone Fax _____ (Email address)
Bid, Performance and Labor & Materials Payment Bond Surety	Surety: _____ Surety Broker _____ _____ (Surety Broker Contact Name) _____ (Street Address) _____ (City, State & Zip Code) (_____) _____ (_____) _____ Telephone Fax _____ (Email address)
Workers Compensation Insurance	Insurer: _____ Policy No. _____ Broker _____
Workers Compensation Insurance Broker	(Contact Name) _____ _____ (Street Address) _____ (City, State & Zip Code) (_____) _____ (_____) _____ Telephone Fax _____ (Email address)

[CONTINUED NEXT PAGE]

5. Essential Requirements. A Bidder will not be deemed qualified if the answer to any of the following questions results in a "not qualified" response and the Bid Proposal submitted by such a Bidder will be rejected for failure of the Bidder to meet minimum qualifications for the Work.

5.1. Bidder possesses a valid and currently in good standing California Contractors' license for the Classification(s) of Contractors' License required by the Call for Bids.
__ Yes __ No (Not Qualified)

5.2. Bidder is currently a DIR Registered Contractor?
__ Yes __ No (Not Qualified)

5.3. Bidder has completed construction on at least one public works project for a California community college district or school district that was subject to DSA jurisdiction and approval.
__ Yes __ No (Not Qualified)

5.4. Bidder has a current commercial general liability insurance policy with coverage limits of at least $1,000,000 per occurrence and $2,000,000 in the aggregate.
__ Yes __ No (Not Qualified)

5.5. Bidder has a current workers' compensation insurance policy as required by the Labor Code or is legally self-insured pursuant to Labor Code §3700.
__ Yes __ No (Not Qualified)
__ Bidder is exempt from this requirement, because it has no employees

5.6. The Bidder is ineligible or debarred from submitting Bid Proposals for public works projects or public works contracts pursuant Labor Code §1777.1 or Labor Code §1777.7.

__ Yes (Not Qualified) __ No

5.7. A public agency, within the past three (3) years, has conducted proceedings that resulted in a finding that the Bidder, or any predecessor to the Bidder, is not a "responsible" bidder for a public works project or a public works contract.
__ Yes (Not Qualified) __ No

5.8. During the last three (3) years, the Bidder or any predecessor to the Bidder, or any of the equity owners of the Bidder has been convicted of a federal or state crime involving fraud, theft, or any other act of dishonesty?
__ Yes (Not Qualified) __ No

5.9. During the past three (3) years a Surety has completed any project or the Bidder's obligations under a construction contract.
__ Yes (Not Qualified) __ No

5.10. The Bidder's Worker's Compensation Insurance current EMR is more than 1.25.
__ Yes (Not Qualified) __ No

5.11. The Bidder's Worker's Compensation Insurance average EMR over the past five (5) years is more than 1.25.
__ Yes (Not Qualified) __ No

5.12. The Bidder has been subject to a serious and willful violation under Labor Code § 6300 in the past five (5) years.

__ Yes (Not Qualified) __ No

5.13. The Bidder has an Injury and Illness Prevention Program ("IIPP") and the Bidder has submitted its IIPP concurrently with submittal of the Bidder's Bid Proposal.

__ Yes __ No (Not Qualified)

6. Performance/Experience. A Bidder must receive a minimum of 65 points out of a possible 100 points in this section to be deemed "Qualified." The Bid Proposal of a Bidder who is not deemed "Qualified" will be rejected for non-responsiveness.

6.1. Within the past five (5) years has your organization has completed public works projects for California community college districts or school districts that were subject to DSA jurisdiction and approval.?

__ Yes ___ No

If yes, number of such projects: _____

Yes 1-2 Projects:	5 points
Yes 3-5 Projects:	10 points
Yes 6 or more Projects	15 points
No	0 points

If yes, list the number of project for which your organization served as the general contractor or as a subcontractor?

__ General Contractor __ Subcontractor

6.2. Has a complaint ever been filed against your organization's California Contractors' License with the California Contractors' State License Board?

__ Yes ___ No

Yes: 0 points
No: 5 points

6.3. Has your organization ever asked to be relieved of or refused to sign a contract for construction services awarded to it?

__ Yes ___ No

Yes: 0 points
No: 5 points

6.4. Has your organization ever failed to complete a construction contract?

__ Yes ___ No

Yes: 0 points
No: 10 points

6.5. Has your organization ever been declared in default of a construction contract?

__ Yes ___ No

Yes: 0 points
No: 5 points

6.6. Has your organization ever failed to complete a public works construction contract within the authorized time?

__ Yes ___ No

Yes: 0 points
No: 10 points

6.7. Has your organization ever been assessed and paid liquidated damages under a construction contract with either a public or private owner?

__ Yes ___ No

Yes: 0 points
No: 10 points

6.8. Has your organization ever been denied an award of a public works contract based upon a finding by a public agency that your organization was not a responsible bidder?

__ Yes ___ No

Yes: 0 points
No: 10 points

6.9. Has your organization or any principal of your organization ever been found guilty of violating any federal, state or local law, rule or regulation regarding a construction contract?

__ Yes ___ No

Yes: 0 points
No: 10 points

6.10. Has any insurance carrier, for any policy of insurance, refused to renew an insurance policy for your organization?

__ Yes ___ No

If yes, on how many occasions? _____

No occasions - 10 points
1 occasion - 3 points
More than 1 occasion - 0 points

6.11. During the past five (5) years, has a surety declined to issue a surety bond for your organization in connection with a construction project?

__ Yes ___ No

If yes, on how many occasions? _____

No occasions 10 points
1 occasion 3 points
More than 1 occasion 0 points

7. **Safety**. Bidder must receive a minimum of 25 points out of a possible 35 points in this section.

7.1. Has CAL OSHA cited and assessed penalties against your firm for any "serious," "willful" or "repeat" violations of its safety or health regulations in the past five (5) years?

__ Yes ___ No

If yes, on how many occasions? _____

1 or less occasion - 5 points
2 occasions - 3 points
More than 2 occasions - 0 points

7.2. Has the Federal Occupational Safety and Health Administration ("OSHA") cited and assessed penalties against your firm in the past five (5) years?

__ Yes ___ No
If yes, on how many occasions? _____
1 or less occasion - 5 points
2 occasions - 3 points
More than 2 occasions - 0 points

7.3. Has the EPA, any Air Quality Management District or any Regional Water Quality Control Board cited and assessed penalties against either your firm or the owner of a project on which your firm was the contractor in the past five years?
__ Yes ___ No
If yes, on how many occasions? _____
1 or less occasion - 5 points
2 occasions - 3 points
More than 2 occasions - 0 points

7.4. How often do you require documented safety meetings to be held for construction employees and field supervisors during the course of a project? _____
Once a week or more often - 5 points
Any other answer - 0 points

7.5. List your firm's Workers' Compensation Insurance Experience Modification Rate (EMR) for each of the past three (3) premium years: (Note: An Experience Modification Rate is issued to your firm annually by your workers' compensation insurance carrier).
Current year: _____
Previous year: _____
Year prior to previous year: _____
Three-year average EMR of .95 or less - 5 points
Three-year average EMR or more than .95 but no more than 1.1 - 3 points
Any other EMR - 0 points

7.6. Has there been more than one occasion during the last five (5) years on which your firm was required to pay either back wages or penalties for your own firm's failure to comply with California's prevailing wage laws? (Note: This question refers only to your own firm's violation of prevailing wage laws, not to violations of the prevailing wage laws by a subcontractor to your firm.)
__ Yes ___ No
If yes, on how many occasions? _____
2 or less occasions - 5 points
3 occasions - 3 points
More than 3 occasions - 0 points

7.7. At any time during the last five years, has your firm been found to have violated any provision of California apprenticeship laws or regulations, or the laws pertaining to use of apprentices on public works?
__ Yes ___ No
If yes, provide the date(s) of such findings, and attach copies of the Department's final decision(s): _____
2 or less occasions - 5 points
3 occasions - 3 points
More than 3 occasions - 0 points

8. Legal/Administrative Proceedings and Surety. If the response to any of the following questions is a "yes" complete and accurate details must be attached; failure to attach such details will render the Bid Proposal of the Bidder to be non-responsive and rejected. Responses to the following will be used to evaluate Bidder responsibility.

8.1. Have legal, arbitration or administrative proceedings been brought by the construction project owner against the Bidder or any of the principals, officers or equity owners of the Bidder within the past ten (10) years which arise out of or are related to any construction project?

__ Yes __ No

If "yes," on a separate attachment, include the following details: (i) name of party initiating proceedings against the Bidder; (ii) contact name, address, phone and email address of party initiating proceedings; (iii) circumstances resulting in the initiation of proceedings; (iv) amount or other relief demanded; and (v) outcome of proceedings.

8.2. Has the Bidder brought any legal, arbitration or administrative proceedings against the owner of a construction project within the past ten (10) years which arise out of or are related to the construction project, excluding claims for personal injury?

__ Yes __ No

If "yes," on a separate attachment, include the following details: (i) name of owner; (ii) contact name, address, phone and email address of contact person for owner; (iii) circumstances resulting in the initiation of proceedings; (iv) amount or other relief demand; and (v) outcome of proceedings.

8.3. At any time during the past five (5) years, has any surety company made any payments on behalf the Bidder to satisfy any claims made against a bid, performance or payment bond issued to the Bidder, in connection with a construction project, either public or private?

____ Yes ____ No

If "yes," on a separate attachment set forth: (i) the amount of each such claim; (ii) the name and telephone number of the claimant; (iii) the date of the claim; (iv) the grounds for the claim; (v) the present status of the claim; (vi) the date of resolution of such claim if resolved; (vii) the method by which such was resolved if resolved; (viii) the nature of the resolution; and (ix) the amount, if any, at which the claim was resolved.

8.4. During the past five (5) years, has a surety declined to issue a surety bond for your organization in connection with a construction project?

____ Yes ____ No

If "yes" on a separate attachment provide details of the denial of bond coverage and the name of the company or companies which denied coverage.

8.5. In the last five years has any insurance carrier, for any policy of insurance, refused to renew the insurance policy for your firm?

____ Yes ____ No

8.6. Within the past five (5) years, has the Bidder been required to pay either back wages or penalties for the Bidder's failure to comply with California prevailing wage laws? This question refers only to the Bidder's violation of prevailing wage laws, not to violations of the prevailing wage laws by a subcontractor.

____ Yes ____ No

If "yes," on a separate attachment: (i) describe each instance of prevailing wage rate violation; (ii) identify the project on which a prevailing wage rate violation occurred; (iii) the public agency owner of the project; (iv) the number of employees affected by each prevailing wage rate violation; and (v) amount of back wages and penalties the Bidder was required to pay.

8.7. Within the past five (5) years, has there been more than one occasion in which the Bidder was penalized or required to pay back wages for failure to comply with the Federal Davis-Bacon prevailing wage requirements?

____ Yes ____ No

If "yes," on a separate attachment: (i) describe each instance of prevailing wage rate violation; (ii) identify the project on which a prevailing wage rate violation occurred; ((iii) the number of employees affected by each prevailing wage rate violation; and (iv) amount of back wages and penalties the Bidder was required to pay.

8.8. Within the past five (5) years, has the Bidder been found to have violated any provision of California apprenticeship laws or regulations, or the laws pertaining to use of apprentices on public works projects?

____ Yes ____ No

If "yes," provide the date(s) of such findings, and attach copies of the Apprenticeship Counsel's final decision(s).

9. References.

9.1. On a separate attachment, provide the following information for three (3) projects the Bidder has completed for a community college district or school district subject to DSA jurisdiction and approval within the past five (5) years that are similar in size, scope, function and construction value as the Work:

Project Name	
Project Owner; Contact Information	
Architect Name; Contact Information	
Original Contract Duration	
Actual Project Completion Duration	
Original Contract Price	
Final Adjusted Contract Price	

9.2. On a separate attachment, provide the following information for all projects the Bidder has completed within the three (3) years, including the following information:

Project Name	
Project Owner; Contact Information	
Architect Name; Contact Information	
Original Contract Duration	
Actual Project Completion Duration	
Original Contract Price	
Final Adjusted Contract Price	

9.3. On a separate attachment, provide the following information for all projects the Bidder currently has in progress, including the following information:

Project Name	
Project Owner; Contact Information	
Architect Name; Contact Information	
Original Contract Duration	
Projected Completion Duration	
Original Contract Price	
Current Adjusted Contract Price	

10. Accuracy and Authority. The undersigned is duly authorized to execute this Statement of Qualifications under penalty of perjury on behalf of the above-identified Bidder. The undersigned warrants and represents that he/she has personal knowledge of each of the responses to this Statement of Qualifications and/or that he/she has conducted all necessary and appropriate inquiries to determine the truth, completeness and accuracy of responses to this Statement of Qualifications. The undersigned declares and certifies that the responses to this Statement of Qualifications are complete and accurate; there are no omissions of material fact or information that render any response to be false or misleading and there are no misstatements of fact in any of the responses. The above-identified Bidder acknowledges and agrees that if the District determines that any response herein is false or misleading or contains misstatements of fact so as to be false or misleading, the Bidder's Bid Proposal may be rejected by the District for non-responsiveness.

Executed this___ day of _____ 20__ at_____.
(City and State)

I declare under penalty of perjury under California law that the foregoing is true and correct.

By: _____
(Signature of Bidder's Authorized Officer or Representative)

_____
(Typed or Printed Name)

Title: _____

NON-COLLUSION DECLARATION

PROJECT: Instructional Building 2, Bid No. CCC-055

The undersigned declares:

I am _____,

_____
(Insert "Sole Owner", "Partner", "President, "Secretary", or other proper title)

of_____
(Insert name of bidder)

As the party submitting a Bid Proposal for the above-identified Project, the undersigned declares, states and certifies that:

1. The Bid Proposal is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization or corporation.

2. The Bid Proposal is genuine and not collusive or sham.

3. The Bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid, and has not directly or indirectly colluded, conspired, connived, or agreed with any other bidder or anyone else to put in sham bid, or to refrain from bidding.

4. The Bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix the bid price, or that of any other bidder, or to fix any overhead, profit or cost element of the bid price or that of any other bidder, or to secure any advantage against the public body awarding the contract or of anyone interested in the proposed contract.

5. All statements contained in the Bid Proposal and related documents are true.

6. The Bidder has not, directly or indirectly, submitted the bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid, and will not pay, any fee to any person, corporation, partnership, company, association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid.

Executed this ____ day of _____, 20__ at _____.
(City, County and State)

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

_____ _____
Signature (Address)

_____ _____
Name Printed or Typed (City, County and State)

(_____) _____
(Area Code and Telephone Number)

CERTIFICATE OF WORKERS' COMPENSATION INSURANCE

I,_____ the _____of
(Name) (Title)
_____, declare, state and certify that:
(Contractor Name)

1. I am aware that California Labor Code § 3700(a) and (b) provides:

   "Every employer except the state shall secure the payment of compensation in one or more of the following ways:

   (a) By being insured against liability to pay compensation in one or more insurers duly authorized to write compensation insurance in this state.

   6. (b) By securing from the Director of Industrial Relations a certificate of consent to self-insure either as an individual employer, or one employer in a group of employers, which may be given upon furnishing proof satisfactory to the Director of Industrial Relations of ability to self-insure and to pay any compensation that may become due to his or her employees."

2. I am aware that the provisions of California Labor Code §3700 require every employer to be insured against liability for workers' compensation or to undertake self-insurance in accordance with the provisions of that code, and I will comply with such provisions before commencing the performance of this Contract.

_____
(Contractor Name)

By:_____
(Signature)

_____
(Typed or printed name)

DRUG-FREE WORKPLACE CERTIFICATION

I, _____, am the _____ of
(Print Name) (Title)

_____
(Contractor Name)

I declare, state and certify to all of the following:

1. I am aware of the provisions and requirements of California Government Code §§8350 et seq., the Drug Free Workplace Act of 1990.

2. I am authorized to certify, and do certify, on behalf of Contractor that a drug free workplace will be provided by Contractor by doing all of the following:

   A. Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensation, possession or use of a controlled substance is prohibited in Contractor's workplace and specifying actions which will be taken against employees for violation of the prohibition;

   B. Establishing a drug-free awareness program to inform employees about all of the following:

      i. The dangers of drug abuse in the workplace;

      ii. Contractor's policy of maintaining a drug-free workplace;

      iii. The availability of drug counseling, rehabilitation and employee-assistance programs; and

      iv. The penalties that may be imposed upon employees for drug abuse violations;

   C. Requiring that each employee engaged in the performance of the Contract be given a copy of the statement required by subdivision (A), above, and that as a condition of employment by Contractor in connection with the Work of the Contract, the employee agrees to abide by the terms of the statement.

   D. Contractor agrees to fulfill and discharge all of Contractor's obligations under the terms and requirements of California Government Code §8355 by, inter alia, publishing a statement notifying employees concerning: (i) the prohibition of any controlled substance in the workplace, (ii) establishing a drug-free awareness program, and (iii) requiring that each employee engaged in the performance of the Work of the Contract be given a copy of the statement required by California Government Code §8355(a) and requiring that the employee agree to abide by the terms of that statement.

3. Contractor and I understand that if the District determines that Contractor has either: (i) made a false certification herein, or (ii) violated this certification by failing to carry out and to implement the requirements of California Government Code §§8355, the Contract awarded herein is subject to termination, suspension of payments, or both. Contractor and I further understand that, should Contractor violate the terms of the Drug-Free Workplace Act of 1990, Contractor may be subject to debarment in accordance with the provisions of California Government Code §§8350, et seq.

4. Contractor and I acknowledge that Contractor and I are aware of the provisions of California Government Code §§8350, et seq. and hereby certify that Contractor and I will adhere to, fulfill, satisfy and discharge all provisions of and obligations under the Drug-Free Workplace Act of 1990.

I declare under penalty of perjury under the laws of the State of California that all of the foregoing is true and correct.

Executed at _____ this ____day of
(City and State)
_____, 20____.

_____
(Signature)

_____
(Printed or Typed Name)

AGREEMENT

THIS AGREEMENT is entered into in the City of Compton, County of Los Angeles, State of California, by and between **COMPTON COMMUNITY COLLEGE DISTRICT**, a California Community College District hereinafter "District" and TBD ("Contractor").

WITNESSETH, that the District and the Contractor in consideration of the mutual covenants contained herein agree as follows:

1. The Work. Within the Contract Time and for the Contract Price, subject to adjustments thereto pursuant to the Contract Documents, the Contractor shall perform and provide all necessary labor, materials, tools, equipment, utilities, services and transportation to complete in a workmanlike manner all of the Work required in connection with the work of improvement commonly referred to as **Instructional Building 2, Bid No. CCC-055**. Contractor shall complete all Work covered by the Contract Documents, including without limitation, the Drawings and Specifications prepared by the Architect, tBP Architecture, and other Contract Documents enumerated in Article 6 below, along with all modifications and addenda thereto issued in accordance with the Contract Documents.

2. Contract Time. The Contractor shall achieve Substantial Completion the Work within the Contract Time which is **TBD** ( ) calendar days after the date established in the Notice to Proceed issued by or on behalf of the District for commencement of the Work.

3. Contract Price. The District shall pay the Contractor as full consideration for the Contractor's full, complete and faithful performance of the Contractor's obligations under the Contract Documents, subject to adjustments of the Contract Price in accordance with the Contract Documents, the Contract Price of Dollars ($.00). The District's payment of the Contract Price shall be in accordance with the Contract Documents. The Contract Price includes an Allowance in the amount of Dollars ($500,000.00). The use, application and handling of any unused portion of the Allowance shall be in accordance with Paragraph 14 of the Special Conditions.

4. Unit Price Items. If the Bid Proposal for the Work includes a proposal(s) for Unit Price Item(s), during Contractor's performance of the Work, the District may elect to add or delete any such Unit Price Item(s). If the District elects to add or delete any such Unit Price Item(s) pursuant to the foregoing, the debit or credit for such Unit Price Item(s) shall be in accordance with the amount(s) set forth in the Contractor's Unit Price Item(s) Proposal, attached as Attachment A to the Contractor's Bid Proposal.

5. Liquidated Damages. The Contractor shall be subject to assessment of Liquidated Damages set forth in the Special Conditions if the Contractor: (i) fails to submit each Submittal required by the Contract Documents in accordance with the Submittal Schedule incorporated into the Contractor's Construction Schedule; or (ii) fails to achieve Substantial Completion of the Work within the Contract Time, subject to adjustments thereto in accordance with the Contract Documents; or (iii) fails to complete all Punchlist items within the time established pursuant to the Contract Documents.

6. Limitation on Damages. In the event of the District's breach or default of its obligations under the Contract Documents, the damages, if any, recoverable by the Contractor shall be limited to general damages which are directly caused by said breach or default of the District and shall exclude any and all special or consequential damages, if any, suffered by the Contractor. By executing this Agreement, the Contractor expressly acknowledges the foregoing limitation to the recovery only of general damages from the District if the District is in breach or default of its obligations under the Contract Documents. The Contractor expressly waives any right to and foregoes the recovery of any special or consequential damages from the District including, without limitation, damages for: i) lost or impaired bonding capacity; and/or, ii) lost profits arising out of or in connection with any past, present, or future work of

improvement, except for the Project which is the subject of the Contract Documents; and/or (iii) loss of productivity.

7. The Contract Documents. The documents forming a part of the Contract Documents consist of the following:

00 11 13	Notice Calling for Bids, including Bid Addenda Nos. 1
00 21 13	Instructions for Bidders
00 42 13	Bid Proposal
00 43 24	Pre-Bid Request For Information Form
00 45 00	Subcontractors List
00 45 10	DIR Registration Verification
00 45 13	Statement of Qualifications
00 45 19	Non-Collusion Declaration
00 45 26	Certificate of Workers Compensation
00 45 27	Drug-Free Workplace Certification
00 52 00	Agreement
00 61 10	Bid Bond
00 61 13	Performance Bond
00 61 14	Labor and Material Payment Bond
00 62 90	Verification of Certified Payroll Form to Labor Commissioner
00 65 36	Guarantee Form
00 72 00	General Conditions
00 73 00	Special Conditions
	Special Conditions Attachments A-G
Drawings	
Specifications	

8. Authority to Execute. The individual(s) executing this Agreement on behalf of the Contractor is/are duly and fully authorized to execute this Agreement on behalf of Contractor and to bind the Contractor to each and every term, condition and covenant of the Contract Documents.

CONTRACTORS ARE REQUIRED BY LAW TO BE LICENSED AND REGULATED BY THE CONTRACTORS' STATE LICENSE BOARD. QUESTIONS CONCERNING A CONTRACTOR MAY BE REFERRED TO THE REGISTRAR, CONTRACTORS' STATE LICENSE BOARD, P.O. BOX 2600, SACRAMENTO, CALIFORNIA 95826

IN WITNESS WHEREOF, this Agreement has been duly executed by the District and the Contractor as of the date set forth above.

"DISTRICT" **COMPTON COMMUNITY COLLEGE DISTRICT**	**"CONTRACTOR"**
By _____	By: _____
Title _____	Title: _____

BID BOND

KNOW ALL MEN BY THESE PRESENTS that we, _____, as Surety and _____, as Principal, are jointly and severally, along with their respective heirs, executors, administrators, successors and assigns, held and firmly bound unto **COMPTON COMMUNITY COLLEGE DISTRICT** ("the Obligee") for payment of the penal sum hereof in lawful money of the United States, as more particularly set forth herein.

THE CONDITION OF THIS OBLIGATION IS SUCH THAT:

WHEREAS, the Principal has submitted the accompanying Bid Proposal to the Obligee for the Work commonly described as **Instructional Building 2 Bid No. CCC-055**.

WHEREAS, subject to the terms of this Bond, the Surety and the Principal are jointly and severally firmly bound unto the Obligee in the penal sum equal to Ten Percent (10%) of the maximum amount of the Bid Proposal submitted by the Principal to the Obligee, inclusive of amounts proposed for additive Alternate Bid Items, if any.

NOW THEREFORE, if the Principal shall not withdraw said Bid Proposal within the period specified therein after the opening of the same, or, if no period be specified, for sixty (60) days after opening of said Bid Proposal; and if the Principal is awarded the Contract, and shall within the period specified therefore, or if no period be specified, within five (5) days after the prescribed forms are presented to him for signature, enter into a written contract with the Obligee, in accordance with the Bid Proposal as accepted and give such bond(s) with good and sufficient surety or sureties, as may be required, for the faithful performance and proper fulfillment of such Contract and for the payment for labor and materials used for the performance of the Contract, or in the event of the withdrawal of said Bid Proposal within the period specified for the holding open of the Bid Proposal or the failure of the Principal to enter into such Contract and give such bonds within the time specified, if the Principal shall pay the Obligee the difference between the amount specified in said Bid Proposal and the amount for which the Obligee may procure the required Work and/or supplies, if the latter amount be in excess of the former, together with all costs incurred by the Obligee in again calling for Bids, then the above obligation shall be void and of no effect, otherwise to remain in full force and effect.

Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or the Call for Bids, the Work to be performed there under, the Drawings or the Specifications accompanying the same, or any other portion of the Contract Documents shall in no way affect its obligations under this Bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of said Contract, the Call for Bids, the Work, the Drawings or the Specifications, or any other portion of the Contract Documents.

In the event suit or other proceeding is brought upon this Bond by the Obligee, the Surety and Principal shall be jointly and severally liable for payment to the Obligee all costs, expenses and fees

[CONTINUED NEXT PAGE]

incurred by the Obligee in connection therewith, including without limitation, attorney's fees.

IN WITNESS WHEREOF, the Principal and Surety have executed this instrument this _____ day of _____, 20___ by their duly authorized agents or representatives.

_____
(Bidder/Principal Name)

By: _____
(Signature)

_____
(Typed or Printed Name)

Title: _____

(Attach Notary Public Acknowledgement of Principal's Signature)

_____
(Surety Name)

By: _____
(Signature of Attorney-In-Fact for Surety)

_____
(Typed or Printed Name of Attorney-In-Fact)

(Attach: (i) Attorney-In-Fact Certification; (ii) Notary Public Acknowledgment of Authorizing Signature on Attorney-Fact Certification; and (iii) Notary Public Acknowledgement of Attorney-In-Fact's Signature.)

Contact name, address, telephone number and email address for notices to the Surety

_____
(Contact Name)

_____
(Street Address)

_____
(City, State & Zip Code)

(_____) _____ (_____) _____
Telephone Fax

_____
(Email address)

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS that we, _____, as Surety and _____, as Principal, are jointly and severally, along with their respective heirs, executors, administrators, successors and assigns, held and firmly bound unto **COMPTON COMMUNITY COLLEGE DISTRICT** ("the Obligee") for payment of the penal sum the penal sum of _____ Dollars ($_____) in lawful money of the United States, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally.

THE CONDITION OF THIS OBLIGATION IS SUCH THAT:

WHEREAS, the Obligee, by resolution of its Board of Trustees has awarded to the Principal a Contract for the Work described as **Instructional Building 2, Bid No. CCC-055**.

WHEREAS, the Principal, has entered into an agreement with the Obligee for performance of the Work; the Agreement and all other Contract Documents set forth therein are incorporated herein and made a part hereof by this reference.

WHEREAS, by the terms of the Contract Documents, the Principal is required to furnish a bond ensuring the Principal's prompt, full and faithful performance of the Work of the Contract Documents.

NOW THEREFORE, if the Principal shall promptly, fully and faithfully perform each and all of the obligations and things to be done and performed by the Principal in strict accordance with the terms of the Contract Documents as they may be modified or amended from time to time; and if the Principal shall indemnify and save harmless the Obligee and all of its officers, agents and employees from any and all losses, liability and damages, claims, judgments, liens, costs, and fees of every description, which may be incurred by the Obligee by reason of the failure or default on the part of the Principal in the performance of any or all of the terms or the obligations of the Contract Documents, including all modifications, and amendments, thereto, and any warranties or guarantees required thereunder; then this obligation shall be void; otherwise, it shall be, and remain, in full force and effect.

The Surety, for value received, hereby stipulates and agrees that no change, adjustment of the Contract Time, adjustment of the Contract Price, alterations, deletions, additions, or any other modifications to the terms of the Contract Documents, the Work to be performed thereunder, or to the Specifications or the Drawings shall limit, restrict or otherwise impair Surety's obligations or Obligee's rights hereunder; Surety hereby waives notice from the Obligee of any such changes, adjustments of Contract Time, adjustments of Contract Price, alterations, deletions, additions or other modifications to the Contract Documents, the Work to be performed under the Contract Documents, or the Drawings or the Specifications.

In the event of the Obligee's termination of the Contract due to the Principal's breach or default of the Principal's obligations thereunder, within twenty (20) days after written notice from the Obligee to the Surety of the Principal's breach or default of the Contract Documents and Obligee's termination of the Contract, the Surety shall notify Obligee in writing of Surety's assumption of obligations hereunder by its election to either remedy the default or breach of the Principal or to take charge of the Work of the Contract Documents and complete the Work at its own expense ("the Notice of Election"); provided, however, that the procedure by which the Surety undertakes to discharge its obligations under this

[CONTINUED NEXT PAGE]

Bond shall be subject to the advance written approval of the Obligee, which approval shall not be unreasonably withheld, limited or restricted. The insolvency of the Principal or the Principal's denial of a failure of performance or default under the Contract Documents shall not by itself, without the Surety's prompt, diligent inquiry and investigation of such denial, be justification for Surety's failure to give the Notice of Election or for its failure to promptly remedy the failure of performance or default of the Principal or to complete the Work.

In the event the Surety fails to issue its Notice of Election to Obligee within the time provided for hereinabove, the Obligee may thereafter cause the cure or remedy of the Principal's failure of performance or default or to complete the Work. The Principal and the Surety shall be jointly and severally liable to the Obligee for all damages and costs sustained by the Obligee as a result of the Principal's failure of performance under the Contract Documents or default in its performance of obligations thereunder, including without limitation the costs of cure or completion of the Work exceeding the then remaining balance of the Contract Price; provided that the Surety's liability hereunder for the costs of performance, damages and other costs sustained by the Obligee upon the Principal's failure of performance or default under the Contract Documents shall be limited to the penal sum hereof, which shall be deemed to include the costs or value of any Changes to the Work which increases the Contract Price.

In the event that suit or other proceeding is brought upon this Bond by the Obligee, the Surety and Principal shall be jointly and severally liable for payment to the Obligee of all costs, expenses and fees incurred by the Obligee therewith, including without limitation, attorneys' fees.

IN WITNESS WHEREOF, the Principal and Surety have executed this instrument this _____day of _____, 20____ by their duly authorized agent or representative

_____
(Contractor-Principal Name)

By: _____
(Signature)

_____
(Typed or Printed Name)

Title: _____

(Attach Notary Public Acknowledgement of Principal's Signature)

_____
(Surety Name)

By: _____
(Signature of Attorney-In-Fact for Surety)

_____
(Typed or Printed Name of Attorney-In-Fact)

(Attach: (i) Attorney-In-Fact Certification; (ii) Notary Public Acknowledgment of Authorizing Signature on Attorney-Fact Certification; and (iii) Notary Public Acknowledgement of Attorney-In-Fact's Signature.)

Contact name, address, telephone number and email address for notices to the Surety

_____
(Contact Name)

_____
(Street Address)

_____
(City, State & Zip Code)

(_____) _____ (_____) _____
Telephone Fax

_____
(Email address)

LABOR AND MATERIAL PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS that we, _____, as Surety and _____, as Principal, are jointly and severally, along with their respective heirs, executors, administrators, successors and assigns, held and firmly bound unto **COMPTON COMMUNITY COLLEGE DISTRICT** ("the Obligee") for payment of the penal sum the penal sum of _____ Dollars ($_____) in lawful money of the United States, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally.

THE CONDITION OF THIS OBLIGATION IS SUCH THAT:

WHEREAS, the Obligee, by resolution of its Board of Trustees has awarded to the Principal a Contract for the Work described as **Instructional Building 2, Bid No. CCC-055**.

WHEREAS, the Principal, has entered into an Agreement with the Obligee for performance of the Work, the Agreement and all other Contract Documents set forth therein are incorporated herein by this reference and made a part hereof.

WHEREAS, by the terms of the Contract Documents, the Principal is required to furnish a bond for the prompt, full and faithful payment to any Claimant, as hereinafter defined, for all labor materials or services used, or reasonably required for use, in the performance of the Work.

NOW THEREFORE, if the Principal shall promptly, fully and faithfully make payment: (i) to any Claimant for all labor, materials or services used or reasonably required for use in the performance of the Work; (ii) of amounts due under the Unemployment Insurance Code for work or labor performed under the Contract; and (iii) of amounts required to be deducted, withheld and paid to the Employment Development Department from wages of the employees of the Principal and its Subcontractors under Section 13020 of the Unemployment Insurance Code with respect to work and labor under the Contract then this obligation shall be void; otherwise, it shall be, and remain, in full force and effect.

The term "Claimant" shall refer to any person, corporation, partnership, proprietorship or other entity including without limitation, all persons and entities described in California Civil Code §9100, providing or furnishing labor, materials or services used or reasonably required for use in the performance of the Work under the Contract Documents, without regard for whether such labor, materials or services were sold, leased or rented. This Bond shall inure to the benefit of all Claimants so as to give them, or their assigns and successors, a right of action upon this Bond.

In the event that suit is brought on this Bond by any Claimant for amounts due such Claimant for labor, materials or services provided or furnished by such Claimant, the Surety shall pay for the same and reasonable attorney's fees pursuant to California Civil Code §9554.

The Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration, deletion, addition, or any other modification to the terms of the Contract Documents, the Work to be performed thereunder, the Specifications or the Drawings, or any other portion of the Contract Documents, shall in any way limit, restrict or otherwise affect its obligations under this Bond; the Surety hereby waives notice from the Obligee of any such change, extension of time, alteration, deletion, addition or other modification to the Contract Documents, the Work to be performed under the Contract Documents, the Drawings or the Specifications of any other portion of the Contract Documents.

IN WITNESS WHEREOF, the Principal and Surety have executed this instrument this _____ day of _____, 20__ by their duly authorized agent or representative.

_____
(Contractor-Principal Name)

By: _____
(Signature)

_____
(Typed or Printed Name)

Title: _____

(Attach Notary Public Acknowledgement of Principal's Signature)

_____
(Surety Name)

By: _____
(Signature of Attorney-In-Fact for Surety)

_____
(Typed or Printed Name of Attorney-In-Fact)

(Attach: (i) Attorney-In-Fact Certification; (ii) Notary Public Acknowledgment of Authorizing Signature on Attorney-Fact Certification; and (iii) Notary Public Acknowledgement of Attorney-In-Fact's Signature)

Contact name, address, telephone number and email address for notices to the Surety

_____
(Contact Name)

_____
(Street Address)

_____
(City, State & Zip Code)

(_____) _____ (_____) _____
Telephone Fax

_____
(Email address)

VERIFICATION OF CERTIFIED PAYROLL RECORDS SUBMITTAL TO LABOR COMMISSIONER

I am the _____ for _____ in
(Superintendent/Project Manager) (Contractor)
connection with _____.
(Project Name)

1. This Verification is submitted to Compton Community College District concurrently with the Contractor's submittal of an Application for Progress Payment to the District, identified as Application For Progress Payment No. _____ ("the Pay Application").

2. The Pay Application requests the District's disbursement of a Progress Payment for the value of Work performed between _____, 20___ and _____, 20___.

3. The Contractor has submitted Certified Payroll Records ("CPR") to the Labor Commissioner for all employees of the Contractor engaged in performance of Work subject to prevailing wage rate requirements for the period of time covered by the Pay Application.

4. All Subcontractors who are entitled to any portion of payment to be disbursed pursuant to the Pay Application have submitted their CPRs to the Labor Commissioner for all of their employees performing Work subject to prevailing wage rate requirements for the period of time covered by the Pay Application.

5. I have reviewed the Contractor's CPRs submitted to the Labor Commissioner. The CPRs submitted to the Labor Commissioner by the Contractor are complete and accurate for the period of time covered by the Pay Application.

6. I have reviewed the Subcontractors' CPRs submitted to the Labor Commissioner. The CPRs submitted to the Labor Commissioner by the Subcontractors are complete and accurate for the period of time covered by the Pay Application.

I declare under penalty of perjury under California law that the foregoing is true and correct. I executed this Certification on the ____ day of _____, 20___ at _____.
(City and State)

By: _____

_____
(Typed or Printed Name)

GUARANTEE

Project: **Instructional Building 2**
Bid No: **CCC-055**

The Contractor hereby warrants and guarantees to the District that all work, materials, equipment and workmanship provided, furnished or installed by or on behalf of Contractor in connection with the above referenced Project (the "Work") have been provided, furnished and installed in strict conformity with the Contract Documents for the Work, including without limitation, the Drawings and the Specifications. Contractor further warrants and guarantees that all work, materials, equipment and workmanship as provided, furnished and/or installed are fit for use as specified and fulfill all applicable requirements of the Contract Documents including without limitation, the Drawings and the Specifications. Contractor shall, at its sole cost and expense, repair, correct and/or replace any or all of the work, materials, equipment and/or workmanship of the Work, together with any other items which may be affected by any such repairs, corrections or replacement, that may be unfit for use as specified or defective within a period of one (1) year from the date of the District's Final Acceptance of the Work, ordinary wear and tear and unusual abuse or neglect excepted.

In the event of the Contractor's failure and/or refusal to comply with the provisions of this Guarantee, within the period of time set forth in the Contract Documents after the District's issuance of the Notice to the Contractor of any defect(s) in the Work, materials, equipment or workmanship, Contractor authorizes the District, without further notice to Contractor, to repair, correct and/or replace any such defective item at the expense of the Contractor. The Contractor shall reimburse the District for all costs, expenses or fees incurred by the District in providing or performing such repairs, corrections or replacements within ten (10) days of the District's presentation of a demand to the Contractor for the same.

The provisions of this Guarantee and the provisions of the Contract Documents for the Work relating to the Contractor's Guarantee(s) and warranty(ies) relating to the Work shall be binding upon the Contractor's Performance Bond Surety and all successors or assigns of Contractor and/or Contractor's Performance Bond Surety.

The provisions of this Guarantee are in addition to, and not in lieu of, any provisions of the Contract Documents for the Work relating to the Contractor's guarantee(s) and warranty(ies) or any guarantee(s) or warranty(ies) provided by any material supplier or manufacturer of any equipment, materials or other items forming a part of, or incorporated into the Work, or any other guarantee or warranty obligation of the Contractor, prescribed, implied or imposed by law.

The undersigned individual executing this Guarantee on behalf of Contractor warrants and represents that he/she is duly authorized to execute this Guarantee on behalf of Contractor and to bind Contractor to each and every provision hereof.

Contractor

_____
(Contractor Name)

_____
(Signature of Contractor's Authorized Employee, Officer Or Representative)

_____
(Printed Name and Title)

_____
(Date)

GENERAL CONDITIONS

GENERAL CONDITIONS
TABLE OF CONTENTS

GENERAL CONDITIONS

ARTICLE 1: DEFINITIONS

1.1 District. "District" refers t**o COMPTON COMMUNITY COLLEGE DISTRICT** and unless otherwise stated, includes the District's authorized representatives, including the Construction Manager, if a Construction Manager is designated, the District's Board of Trustees and the District's officers, employees, agents and representatives.

1.2 Contractor. The Contractor is the person or entity identified as such in the Agreement; references to "Contractor" include the Contractor's authorized representative.

1.3 Architect. The Architect is the person or entity identified as such in the Agreement; references to the "Architect" include, as required by context of usage, the Architect of Record, or if not Architect is designated, alternatively, the Engineer of Record, the Architect's or Engineer's employees and authorized representative(s) and the Architect's or Engineer's Consultants and their employees and authorized representative(s).

1.4 The Work. The Work is the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment or services provided or to be provided by the Contractor to fulfill the Contractor's obligations under the Contract Documents. The Work may constitute the whole or a part of the Project.

1.5 The Project. The Project is the total construction of which the Work performed by the Contractor under the Contract Documents may be the whole or a part of the Project and which may include construction by the District or by separate contractors.

1.6 Surety. The Surety is the person or entity that executes, as surety, the Contractor's Labor and Material Payment Bond and/or Performance Bond.

1.7 Subcontractors; Sub-Subcontractors. A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work. "Subcontractor" does not include a separate contractor to the District or subcontractors of any separate contractor. A Sub-Subcontractor is a person or entity of any tier, who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the Site. References to "Subcontractor" shall include Sub-Subcontractors.

1.8 Material Supplier. A Material Supplier is any person or entity who only furnishes materials, equipment or supplies for the Work without fabricating, installing or consuming them in the Work.

1.9 Drawings and Specifications. The Drawings are the graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, showing generally, the design, location and dimensions of the Work and may include without limitation, plans, elevations, sections, details, schedules or diagrams. The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, construction systems, standards, criteria and workmanship for the Work and related services. The Drawings and Specifications are intended to delineate and describe the Work and its component parts so as to permit skilled and competent contractors to bid upon the Work and prosecute the same to completion.

1.10 Special Conditions; Supplemental Conditions. Special Conditions and/or Supplemental

Conditions, if any are special or supplemental provisions, not otherwise provided for in the Agreement or the General Conditions.

1.11 Contract Documents. The Contract Documents consist of the Agreement between the District and the Contractor, Conditions of the Contract (whether General, Special, Supplemental or otherwise), Drawings, Specifications, including addenda thereto issued prior to execution of the Agreement and any other documents listed in the Agreement. The Contract Documents shall include modifications issued after execution of the Agreement. The Contract Documents form the Contract for Construction.

1.12 Intent and Correlation of Contract Documents.

1.12.1 Work of the Contract Documents. The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required to the extent consistent with the Contract Documents and reasonably inferable therefrom as being necessary to produce the intended results. Organization of the Specifications into divisions, sections or articles, and the arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade. Where any portion of the Contract Documents is silent and information appears elsewhere in the Contract Documents, such other portions of the Contract Documents shall control.

1.12.2 Technical Terms. Unless otherwise stated in the Contract Documents, words or terms which have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

1.12.3 Conflict in Contract Documents. Conflicts, inconsistencies or ambiguities in the Contract Documents shall be resolved by the Architect in accordance with Article 3.1.10 of the General Conditions; where conflicts or inconsistencies arise between the Drawings and the Specifications, in resolving such conflicts or inconsistencies, the Architect will be governed generally by the following standards: the Drawings are intended to describe matters relating to placement, type, quantity and the like; the Specifications are intended to describe matters relating to quality, materials, compositions, manufacturers and the like. If conflicts exist between portions of the Contract Documents regarding the quality of any item, product, equipment or materials, unless otherwise directed or authorized by the District, the Contractor shall provide the item, product, equipment or material of the highest or more stringent quality.

1.13 Shop Drawings; Samples; Product Data ("Submittals"). Shop Drawings are diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Material Supplier, or others to illustrate some portion of the Work. Samples are physical examples of materials, equipment or workmanship forming a part of, or to be incorporated into the Work. Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work. Shop Drawings, Samples and Product Data prepared or furnished by the Contractor, Subcontractors or Material Suppliers are collectively referred to as "Submittals".

1.14 Division of State Architect ("DSA"). DSA is the California Division of the State Architect including without limitation the DSA's Office of Construction Services, Office of Design Services and the Office of Regulatory Services; references to the DSA in the Contract Documents shall mean the DSA, its offices and its authorized employees and agents. The authority of the DSA over the Work and the performance thereof shall be as set forth in the Contract Documents and

Title 24 of the California Code of Regulations.

1.15 Project Inspector. The Project Inspector is the individual designated and employed by the District in accordance with the requirements of Title 24 of the California Code of Regulations. The Project Inspector shall be authorized to act on behalf of the District as provided for in the Contract Documents and in Title 24 of the California Code of Regulations, as the same may be amended from time to time.

1.16 Contract Document Terms. The term "provide" means "provide complete in place" or to "furnish and install" such item. Unless otherwise provided in the Contract Documents, the terms "approved;" "directed;" "satisfactory;" "accepted;" "acceptable;" "proper;" "required;" "necessary" and "equal" shall mean as approved, directed, satisfactory, accepted, acceptable, proper, required, necessary and equal, in the opinion of the Architect. The term "typical" as used in the Drawings shall require the installation or furnishing of such item(s) of the Work designated as "typical" in all other areas similarly marked as "typical"; Work in such other areas shall conform to that shown as "typical" or as reasonably inferable therefrom.

1.17 Contractor's Superintendent. The Contractor's Superintendent is the individual employed by the Contractor whose principal responsibility shall be the supervision and coordination of the Work; the Contractor's Superintendent shall not perform routine construction labor.

1.18 Record Drawings. The Record Drawings are a set of the Drawings marked by the Contractor during the performance of the Work to indicate completely and accurately the actual as-built condition of the Work. The Record Drawings shall be sufficient for a capable and qualified draftsman to modify the Drawings to reflect and indicate the Work actually in place at Final Completion of the Work.

1.19 Construction Manager. The Construction Manager, if any, is the individual or entity designated as such in the Special Conditions. The Construction Manager is an independent contractor retained by the District and shall be authorized and empowered to act on behalf of the District. In the event that a Construction Manager is not designated in the Special Conditions, the District reserves the right to designate a Construction Manager at any time during Contractor's performance of the Work. The District reserves the right to remove or replace the Construction Manager during Contractor's performance of the Work. The designation of a Construction Manager, if one has not been designated in the Special Conditions, or the removal or replacement of the designated Construction Manager shall not result in adjustment of the Contract Price or the Contract Time or otherwise affect, limit or restrict Contractor's obligations hereunder.

1.20 Construction Equipment. Construction Equipment is equipment utilized for the performance of any portion of the Work, but which is not incorporated into the Work.

1.21 Site. The Site is the physical area designated in the Contract Documents for Contractor's performance, construction and installation of the Work.

1.22 Field Clarifications. A written or graphic document consisting of supplementary details, instructions or information issued on behalf of the District which clarifies or supplements the Contract Documents and which becomes a part of the Contract Documents upon issuance. Field Clarifications do not constitute an adjustment of the Contract Time or the Contract Price, unless a Change Order relating to a Field Clarification is authorized and issued under the Contract Documents.

1.23 Defective or Non-Conforming Work. Defective or Non-Conforming Work is any Work which is unsatisfactory, faulty or deficient by: (i) not conforming to the requirements of the Contract Documents; (ii) not conforming to the standards of workmanship of the applicable trade or industry; (iii) not being in compliance with the requirements of any inspection, reference, standard, test, or approval required by the Contract Documents; or (iv) damage occurring prior to Final Completion of all of the Work.

1.24 Delivery. Delivery used in conjunction with any equipment, materials or other items to be incorporated into the Work shall mean the unloading and storage in a protected condition at the Site pending incorporation into the Work.

1.25 Notice to Proceed. The Notice to Proceed is the written notice issued by or on behalf of the District to the Contractor authorizing the Contractor to proceed with commencement of the Work and which establishes the date for commencement of the Contract Time.

1.26 Progress Reports; Verified Reports. Progress Reports, if required, are written reports prepared by the Contractor and periodically submitted to the District in the form and content as required by the Contract Documents. Verified Reports are periodic written reports prepared by the Contractor and submitted to the DSA; Verified Reports shall be in such form and content as required by the applicable provisions of Title 24 of the California Code of Regulations. A material obligation of the Contractor is the preparation of complete and accurate Progress Reports, if required, and Verified Reports as well as the timely submission of the same.

1.27 Laws. Laws refer to all laws, ordinances, codes, rules and/or regulations promulgated by any governmental or quasi-governmental agency with jurisdiction over any portion of the Work and which apply to any portion of the Work, including those in effect as of the execution of the Agreement, amendments thereto and subsequently enacted Laws that take effect during the performance of the Work. No adjustment of the Contract Time or the Contract Price shall be allowed for the Contractor's compliance with the Laws.

1.28 Construction Change Directive. A Construction Change Directive is a written instrument issued by or on behalf of the District to the Contractor directing a Change to the Work prior to the Contractor and District reaching full agreement on an adjustment of the Contract Time and/or Contract Price on account of such Change. A material obligation of the Contractor is timely performance of Work noted in a Construction Change Directive.

ARTICLE 2: DISTRICT

2.1 Information Required of District.

2.1.1 Surveys; Site Information. Information, if any, concerning physical characteristics of the Site, including without limitation, surveys, soils reports, and utility locations, to be provided by the District are set forth in the Contract Documents. Information not provided by the District or necessary information in addition to that provided by the District concerning physical characteristics of the Site which is required shall be obtained by Contractor without adjustment to the Contract Price or the Contract Time.

2.1.2 Permits, Approvals. Except as otherwise provided in the Contract Documents, the District shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities which relate to the Work. If permits, licenses, approvals or similar approvals relating to the Work, or the installation/construction thereof are designated as the responsibility of the Contractor under the Contract Documents, the Contractor shall obtain the same without adjustment of the Contract Price or the Contract Time.

2.1.3 Drawings and Specifications. Except as otherwise provided for in the Contract Documents, the District shall furnish the Contractor, free of charge, the number of copies of the Drawings and the Specifications as set forth in the Special Conditions. All of the Drawings and the Specifications provided by the District to the Contractor remain the property of the District; the Contractor shall not use the Drawings or the Specifications in connection with any other work of improvement other than the Work.

2.1.4 Furnishing of Information. Information or services to be provided by the District under the Contract Documents shall be furnished by the District with reasonable promptness to avoid delay in the orderly progress of the Work. Information about existing conditions furnished by the District under the Contract Documents is obtained from sources believed to be reliable, but the District neither guarantees nor warrants that such information is complete and accurate. The Contractor shall verify all information provided by the District. If the Contract Documents depict existing conditions on or about the Site, or the Work involves the renovation, removal or remodeling of existing improvements or the Work involves any tie-in or other connection with existing improvements, the conditions and/or existing improvements depicted in the Contract Documents are as they are believed to exist. The Contractor shall bear the risk of any variations between conditions or existing improvements depicted in the Contract Documents and those conditions or existing improvements actually encountered in the performance of the Work. The existence of any variations between conditions or existing improvements depicted in the Contract Documents and those actually encountered in the performance of the Work shall not result in any District liability therefor, nor shall any such variations result in an adjustment of the Contract Time or the Contract Price.

2.2 District's Right to Stop the Work. In addition to the District's right to suspend the Work or terminate the Contract pursuant to the Contract Documents, the District, may, by written order, direct the Contractor to stop the Work, or any portion thereof, until the cause for such stop work order has been eliminated if the Contractor: (i) fails to correct Work which is not in conformity and in accordance with the requirements of the Contract Documents, or (ii) otherwise fails to carry out the Work in conformity and accordance with the Contract Documents. The right of the District to stop the Work hereunder shall not be deemed a duty on the part of the District to exercise such right for the benefit of the Contractor or any other person or entity, nor shall the District's exercise of such right: (i) waive or limit the exercise of any other right or remedy of the District under the Contract Documents or the Laws; or (ii) result in adjustment of the Contract Time or Contract Price.

2.3 Partial Occupancy or Use.

2.3.1 District's Right to Partial Occupancy. The District may occupy or use any completed or partially completed portion of the Work, provided that: (i) the District has obtained the consent of, or is otherwise authorized by, public authorities with jurisdiction thereof, to so occupy or use such portion of the Work and (ii) the District and the Contractor have accepted, in writing, the responsibilities assigned to each of them for security, maintenance, utilities, damage to the Work, insurance, the period for correction of the Work and commencement of warranties required by the Contract Documents for such portion of the Work partially used or occupied by the District. If the Contractor and the District are unable to agree upon the matters set forth in (ii) above, the District may nevertheless use or occupy any portion of the Work, with the responsibility for such matters subject to resolution in accordance with the Contract Documents. Immediately prior to such partial occupancy or use of the Work, or portions thereof, the District, the Project Inspector, the Construction Manager, the Contractor and the Architect shall jointly inspect the portions of the Work to be occupied or to be used to determine and record the condition of the Work. Repairs, replacements or other corrective action noted

in such inspection shall be promptly performed and completed by the Contractor so that the portion of the Work to be occupied or used by the District is in conformity with the requirements of the Contract Documents and the District's occupancy or use thereof is not impaired. The District's use or occupancy of the Work or portions thereof pursuant to the preceding shall not be deemed "completion" of the Work as that term is used in Public Contract Code §7107.

2.3.2 No Acceptance of Defective or Nonconforming Work. The District's partial occupancy or use of the Work, or any portion thereof, shall not constitute the District's acceptance of the Work which is defective or non-conforming.

2.4 The Project Inspector.

2.4.1 Authority of Project Inspector. In addition to the authority and rights of the Project Inspector as provided for elsewhere in the Contract Documents and/or the Laws, all of the Work shall be performed under the observation of the Project Inspector. The foregoing notwithstanding, the Contractor shall not perform any Work deviating from the Contract Documents solely on the basis of direction by the Project Inspector; such deviations shall be deemed defective or non-conforming Work subject to correction or replacement at the sole cost of the Contractor and without adjustment of the Contract Time. The performance of the duties of the Project Inspector shall not relieve or limit the Contractor's performance of its obligations under the Contract Documents.

2.4.2 Limitations on Project Inspector. The Project Inspector does not have authority to interpret the Contract Documents or to modify the Work depicted in the Contract Documents. The Project Inspector has no authority relative to the content or scope of the Contractor's safety plan/program. The Contractor shall not perform any Work deviating from the Contract Documents solely on the basis of direction by the Project Inspector; such deviations shall be deemed Defective or Non-Conforming Work subject to correction or replacement at the sole cost of the Contractor and without adjustment of the Contract Time.

2.4.3 Contractor Access for Project Inspector. The Contractor shall provide the Project Inspector with access to all parts of the Work at any time, wherever located and whether partially or completely fabricated, manufactured, furnished or installed.

2.4.4 Contractor and District Responsibilities for Costs and Fees of Project Inspector. The District is responsible only for payment of the fees of the Project Inspector for standard eight (8) hour work day Mondays through Fridays, excepting holiday days ("Project Inspector Standard Workdays"). All services provided by the Project Inspector exceeding an eight (8) hour workday Mondays through Fridays and/or the first eight (8) hours on Saturday shall be at 1½ times the Project Inspector's basic hourly rate. All hours of service provided by the Project Inspector in excess of eight (8) hours on Saturdays, and all hours of service provided by the Project Inspector on holiday days or on Sundays are at two (2) times the Project Inspector's basic hourly rate. Fees for services provided by the Project Inspector beyond the Project Inspector Standard Workdays set forth above are the sole responsibility of the Contractor; the District may deduct fees for the Project Inspector which exceeds the Project Inspector Standard Workdays from the Contract Price.

ARTICLE 3: ARCHITECT

3.1 Architect's Administration of the Contract.

3.1.1 Administration of Contract. The Architect will provide administration of the Contract as described in the Contract Documents, and will be one of the District's representatives during construction until the time of Final Payment. The Architect will advise and consult with the District, the Construction Manager, if any, and the Project Inspector with respect to the administration of the Contract and the Work. The Architect is authorized to act on behalf of the District to the extent provided for in the Contract Documents; and shall have the responsibilities and authority established by the Laws.

3.1.2 Periodic Site Inspections. The Architect will visit the Site at intervals appropriate to the stage of construction to become generally familiar with the progress and quality of the completed Work and to determine, in general, if the Work is being performed in a manner indicating that the Work, when completed, will be in accordance with the Contract Documents. The Architect is not required to make exhaustive or continuous Site inspections to check quality or quantity of the Work. On the basis of Site observations as an architect, the Architect will keep the District informed of the progress of the Work, and will endeavor to guard the District against defects and deficiencies in the Work.

3.1.3 Contractor Responsibility for Construction Means, Methods and Sequences. The Architect will not have control over or charge of and will not be responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, these being solely the Contractor's responsibility. The Architect will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or of any other persons performing portions of the Work.

3.1.4 Review of Applications for Payment. Pursuant to Article 8 hereof, the Architect will review the Contractor's Payment Applications and for Application For Final Payment, evaluate the extent of Work performed and verify to the District the amount properly due the Contractor.

3.1.5 Rejection of Work. The Architect is authorized to reject Work which is defective or does not conform to the requirements of the Contract Documents. Whenever the Architect considers it necessary or advisable, for implementation of the intent of the Contract Documents, the Architect is authorized to require additional inspections or testing of the Work, whether or not such Work is fabricated, installed or completed. Neither this authority of the Architect nor a decision made in good faith by the Architect to exercise or not to exercise such authority shall modify requirements of the Contract Documents or any obligation of the Contractor under the Contract Documents.

3.1.6 Submittals.

3.1.6.1 Processing of Submittals. Submittals required by the Contract Documents shall be prepared by or on behalf of the Contractor in accordance with the requirements of the Contract Documents. If the District retains a Construction Manager for the Work, Submittals shall be transmitted by the Contractor to the Construction Manager for distribution by the Construction Manager to the Architect and the District. Upon completion of the Architect's review of a Submittal, the Construction Manager shall transmit the reviewed Submittal to the Contractor for the Contractor's distribution to its Subcontractor(s) and other affected parties. If the District does not retain a Construction Manager for the Work, Submittals shall be submitted by the Contractor to the Architect or such other party designated in the Contract Documents or by the Architect for review and processing.

3.1.6.2 Architect's Review. The Architect will review and approve or take other appropriate action upon the Contractor's Submittals, but only for the limited

purpose of checking for general conformance with information given and the design concept expressed in the Contract Documents. Review of Submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's Submittals shall not relieve the Contractor of its obligations under the Contract Documents. The Architect's review of Submittals shall not constitute approval of safety measures, programs or precautions or, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item in a Submittal shall not indicate approval of an assembly of which the item is a component with the Submittal(s) required and relating to such assembly have been reviewed by the Architect.

3.1.6.3 Time for Architect's Review. The Architect's review of Submittals will be conducted promptly so as not to delay or hinder the progress of the Work or the activities of the Contractor, the District or the District's separate contractors while allowing sufficient time, in the Architect's reasonable professional judgment, to permit adequate review of Submittals. The foregoing notwithstanding, the Architect's review and return of Submittals will conform with the time limits and other conditions, if any, set forth in the Specifications or the Submittal Schedule if the Submittal Schedule is required by other provisions of the Contract Documents, but shall, under no circumstance, be less than fifteen (15) days.

3.1.7 Issuance of Construction Change Directive. The Architect is authorized to issue Construction Change Directives.

3.1.8 Changes to the Work; Change Orders. The Architect will prepare Change Orders, and may authorize minor Changes in the Work which do not result in adjustment of the Contract Time or the Contract Price.

3.1.9 Completion. In conjunction with the District, Project Inspector, Construction Manager, if any, and the Contractor, the Architect will conduct observations of the Work to determine the date(s) of Substantial Completion and Final Completion. If the District does not designate a Construction Manager for the Work, the Architect shall: (i) be authorized to enforce the Contractor's close-out obligations; and (ii) receive from the Contractor and the records, written warranties and related close-out materials assembled by the Contractor in accordance with the Contract Documents.

3.1.10 Interpretation of Contract Documents. The Architect will interpret and decide matters concerning the requirements of the Contract Documents on written request of either the District or the Contractor. The Architect's response to such requests will be made with reasonable promptness and within the time limits agreed upon, if any. If no agreement is reached establishing the time for the Architect's review and response to requests under this Article 3.1.10, the Architect shall be afforded a fifteen (15) day period after receipt of such request to review and respond thereto. Interpretations and decisions of the Architect will: (i) be consistent with the intent of and reasonably inferable from the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions; (ii) endeavor to secure faithful performance by both the District and the Contractor; (iii) not show partiality to either the District or Contractor; and (iv) not result in liability for results of interpretations or decisions so rendered in good faith. The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

3.1.11 Request for Information. If the Contractor encounters any condition which the Contractor believes, in good faith and with reasonable basis, is the result of an ambiguity,

conflict, error or omission in the Contract Documents (collectively "the Conditions"), Contractor shall timely notify the Architect, in writing, of the Conditions encountered and to request information from the Architect necessary to address and resolve any such Conditions before proceeding with any portion of the Work affected or which may be affected by such Conditions. If the Contractor fails to timely notify the Architect in writing of any Conditions encountered and the Contractor proceeds to perform any portion of the Work containing or affected by such Conditions the Contractor shall bear all costs associated with or required to correct, remove, or otherwise remedy any portion of the Work affected thereby without adjustment of the Contract Time or the Contract Price. In requesting information of the Architect to address and resolve any Conditions the Contractor shall act with promptness in submitting any such written request so as to allow the Architect a reasonable period of time to review, evaluate and respond to any such request, taking into account the then current status of the progress and completion of the Work and the actual or potential impact of any such Conditions upon the completion of the Work within the Contract Time. The Contract Time shall not be subject to adjustment in the event that the Contractor shall fail to timely request information from the Architect. The Architect's responses to any such Contractor request for information shall conform to the standards and time frame set forth in Article 3.1.10 of these General Conditions. The foregoing provisions notwithstanding, if the Architect reasonably determines that any of Contractor's request(s) for information: (i) does not reflect adequate or competent supervision or coordination by the Contractor or any Subcontractor; (ii) does not reflect the Contractor's adequate or competent knowledge of the requirements of the Work or the Contract Documents; or (iii) is not justified for any other reason, Contractor shall be liable to the District for all costs incurred by the District associated with the processing, reviewing, evaluating and responding to any such request for information, including without limitation, fees of the Architect. In responding to any of Contractor's request(s) for information, the Architect shall, in the response, indicate if the Architect has made the determination pursuant to the preceding sentence and, if so, the costs to be borne by the Contractor for the processing, review, evaluation and response to the request for information. Thereafter, the District is authorized to deduct such costs from any portion of the Contract Price then or thereafter due the Contractor.

3.2 Communications; Architect's Role. All communications regarding the Work, the performance thereof or the Contract Documents shall be in writing; verbal communications shall be reduced to writing. If the District does not designate a Construction Manager for the Work, communications between the Contractor and the District shall be through the Architect. Communications between separate contractors, if any, shall be through the Architect.

3.3 Termination of Architect; Substitute Architect. In case of termination of employment of the Architect, the District shall appoint a substitute architect whose status under the Contract Documents shall be that of the Architect.

3.4 Construction Manager. If a Construction Manager is designated for the Work, the Construction Manager shall be a representative of the District until Final Completion is achieved and Final Payment is due the Contractor. The Construction Manager is authorized to act on behalf of the District and in connection with the Work as set forth in the Contract Documents, including without limitation: (i) review of the Contractor's Construction Schedule and updates thereto; (ii) review of the Contractor's Applications for Payment and verification of the amount due the Contractor under an Application for Payment; (iii) conducting the Pre-Construction Meeting, Progress Meetings and/or Special Meetings and maintaining minutes thereof; and (iv)

enforcement of the Contractor's obligations under the Contract Documents, including the Contractor's close-out obligations.

ARTICLE 4: THE CONTRACTOR

4.1 Contractor Review of Contract Documents.

4.1.1 Examination of Contract Documents. The Contractor shall carefully study and compare the Contract Documents with each other and with information furnished by the District pursuant to the Contract Documents and shall at once report to the Architect any errors, inconsistencies or omissions discovered. If the Contractor performs any Work knowing, or with reasonable diligence should have known that, it involves an error, inconsistency or omission in the Contract Documents without prior notice to the Architect of the same, the Contractor shall assume full responsibility for such performance and shall bear all costs for correction of the same without adjustment of the Contract Price.

4.1.2 Field Measurements. Prior to commencement of the Work, or portions thereof, the Contractor shall take field measurements and verify field conditions at the Site and shall carefully compare such field measurements and conditions with information provided in the Contract Documents. Errors, inconsistencies or omissions discovered shall be immediately reported to the Architect along with request for clarification or direction.

4.1.3 Dimensions; Layouts and Field Engineering. Unless otherwise expressly provided, dimensions indicated in the Drawings are intended for reference only. The Drawings are intended to be diagrammatic and schematic in nature; the Contractor is solely responsible for dimensioning and coordinating the Work of the Contract Documents. All field engineering required for laying out the Work and establishing grades for earthwork operations shall be by the Contractor at its expense. Any field engineering or other engineering to be provided or performed by the Contractor under the Contract Documents and required or necessary for the proper execution or installation of the Work shall be provided and performed by an engineer duly registered under the laws of the State of California in the engineering discipline for such portion of the Work.

4.1.4 Work in Accordance With Contract Documents. The Contractor shall perform all of the Work in strict conformity with the Contract Documents, the Laws and Architect accepted Submittals.

4.2 Site Investigation; Subsurface Conditions.

4.2.1 Contractor Investigation. The Contractor is responsible for, and by executing the Agreement acknowledges, that it has carefully examined the Site and has taken all steps it deems reasonably necessary to ascertain all conditions which may affect the Work, or the cost thereof, including, without limitation, conditions bearing upon transportation, disposal, handling or storage of materials; availability of labor or utilities; access to the Site; and the physical conditions and the character of equipment, materials, labor and services necessary to perform the Work. Any failure of the Contractor to do so will not relieve it from the responsibility for fully and completely performing all Work without adjustment to the Contract Price or the Contract Time. The District assumes no responsibility to the Contractor for any understandings or representations concerning conditions or characteristics of the Site, or the Work, made by any of its officers, employees or agents prior to the execution of the Agreement, unless such understandings or representations are expressly set forth in the Contract Documents.

4.2.2 Subsurface Data. By executing the Agreement, the Contractor acknowledges that it has examined the boring data and other subsurface data available and satisfied itself as to the character, quality and quantity of surface and subsurface materials, including without limitation, obstacles which may be encountered in performance of the

Work, insofar as this information is reasonably ascertainable from an inspection of the Site, review of available subsurface data and analysis of information furnished by the District under the Contract Documents. Subsurface data or other soils investigation report provided by the District hereunder are not a part of the Contract Documents. Information contained in such data or report regarding subsurface conditions, elevations of existing grades or below grade elevations are approximate only and are neither guaranteed or warranted by the District to be complete and accurate. The Contractor shall examine all boring and other subsurface data to make its own independent interpretation of the subsurface conditions and acknowledges that its bid is based upon its own opinion of the conditions which may be encountered. The District assumes no responsibility for any conclusions or interpretations made by Contractor on the basis of available subsurface data or other information furnished by District under the Contract Documents.

4.2.3 Subsurface Conditions. If the Work involves digging trenches or other excavations that extend deeper than four feet below the surface, the Contractor shall promptly and before the following conditions are disturbed, notify the Project Inspector, in writing, of any: (i) material that the Contractor believes may be material that is hazardous waste, as defined in California Health and Safety Code §25117, that is required to be removed to a Class I or Class II or Class III disposal site in accordance with provisions of existing law; (ii) subsurface or latent physical conditions at the site differing from those indicated; or (iii) unknown physical conditions at the site of any unusual nature, different materially from those ordinarily encountered and generally recognized as inherent in the Work or the character provided for in the Contract Documents. If upon notice to the District of the conditions described above and upon the District's investigation thereof, the District determines that the conditions so materially differ or involve such hazardous materials which require an adjustment to the Contract Price or the Contract Time, the District shall issue a Change Order in accordance with Article 9 hereof. In accordance with California Public Contract Code §7104, any dispute arising between the Contractor and the District as to any of the conditions listed in (i), (ii) or (iii) above, shall not excuse the Contractor from the completion of the Work within the Contract Time and the Contractor shall proceed with all Work to be performed under the Contract Documents. The District reserves the right to terminate the Contract pursuant to Article 15.2 hereof should the District determine not to proceed because of any condition described in (i), (ii) or (iii) above.

4.3 Supervision and Construction Procedures.

4.3.1 Supervision of the Work. The Contractor shall supervise and direct performance of the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract Documents, unless Contract Documents give other specific instructions concerning these matters. The Contractor shall be responsible for inspection of completed or partially completed portions of Work to determine that such portions are in proper condition to receive subsequent Work.

4.3.2 Responsibility for the Work. The Contractor is responsible to the District for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and all other persons performing any portion of the Work under a contract with the Contractor. The Contractor is not relieved from its obligation to perform the Work in accordance with the Contract Documents either by activities or duties of the Construction Manager, Project Inspector or the Architect, or by tests, inspections or approvals required or performed by persons other than the Contractor.

4.3.3 Surveys. The Contractor shall prepare or cause to be prepared all detailed

surveys necessary for performance of the Work, including without limitation, slope stakes, points, lines and elevations. The Contractor is responsible for the establishment, location, maintenance and preservation of benchmarks, reference points and stakes for the Work without adjustment of the Contract Price. The Contractor is solely responsible for all loss or costs resulting from the loss, destruction, disturbance or damage of benchmarks, reference points or stakes.

4.3.4 Construction Utilities. The District will not furnish and pay the costs of utility services for the Work as set forth in the Special Conditions; all other utilities necessary to complete the Work and the Contractor's obligations hereunder shall be obtained by the Contractor without adjustment of the Contract Price or the Contract Time. The Contractor shall furnish and install necessary or appropriate temporary distributions of utilities, including utilities furnished by the District. Any such temporary distributions shall be removed by the Contractor upon completion of the Work. The costs of all such utility services, including the installation, relocations and removal of temporary distributions thereof, shall be borne by the Contractor and included in the Contract Price.

4.3.5 Existing Utilities; Removal, Relocation and Protection.

4.3.5.1 Contractor Responsibility for Locating Utilities. The Contractor is responsible for locating all below grade drainage lines, storm drains, sewers, domestic water, gas, electrical, hot water and irrigation utility services, vaults, duct banks and other similar items or utilities services (collectively "Underground Facilities") which are shown in the Drawings or other portions of the Contract Documents; or (ii) which are identified in information relating to Underground Facilities maintained by the regional notification center, "Underground Service Alert" ("USA"). Contractor shall locate and mark locations of the Underground Facilities shown in the Contract Documents and information relating to Underground Facilities maintained by USA before proceeding with Work that may: (i) damage, destroy or impair Underground Facilities; or (ii) limit, disrupt or interrupt utility services provided through Underground Facilities. Prior to commencing Work in the proximity of Underground Facilities or other underground structures that can be readily inferred from adjacent surface improvements, Contractor shall further locate, by carefully excavating with small equipment, potholing and principally by hand, such utilities or installations that are to remain and that are subject to damage, destruction or disruption.

4.3.5.2 Contractor Responsibility for Damage to Underground Facilities. Without adjustment of the Contract Time or the Contract Price, the Contractor shall repair or replace all damage to or destruction of Underground Facilities occurring during performance of the Work. All such repairs or replacements shall be with materials, equipment and other items consistent with those in place prior to commencement of the Work and when the repair or replacement is completed, the Underground Facilities shall be in the same functional and operational condition as prior to the damage or destruction.

4.3.5.3 Contractor Responsibility for Maintaining Utility Services. The Contractor shall maintain in service all utility services provided through the Underground Facilities unless the Contractor has notified the District and Construction Manager in writing of utility service disruptions at least two (2) working days in advance of the anticipated disruption of utility services. Notwithstanding the Contractor's notice pursuant to the foregoing, the District may, in the sole discretion of the District, direct alternative times/days for the anticipated utility service disruption as necessary for conduct of on-going activities or operations of the District at and about the Site. The Contractor shall be liable for all costs, fees or charges incurred by the District to provide utility services if there is disruption, interruption or limitation of any utility services for

which the Contractor has not provided the advance written notice of utility disruption pursuant to the foregoing. The District may deduct such costs, fees or charges from the Contract Price then or thereafter due the Contractor.

4.3.5.4 Unmarked; Unknown Utilities. Additional Underground Facilities not shown in the Contract Documents or USA data may exist on or about the Site. The Contractor shall be alert to their existence; if they are encountered, Contractor shall immediately report such Underground Facilities to the Project Inspector, Construction Manager and District for disposition of the same prior to disturbing any existing condition. In accordance with California Government Code §4215, the District is responsible for the timely removal, relocation, or protection of existing main or trunkline utility facilities located on the Site which are not identified in the Contract Documents. Contractor shall be compensated for the costs of locating, repairing damage not due to the Contractor's failure to exercise reasonable care, and removing or relocating such utility facilities not indicated in the Contract Documents with reasonable accuracy, and for equipment on the Site necessarily idled during such work. Contractor shall not be assessed Liquidated Damages for delay in completion of the Work when such delay is caused by the failure of the District or the District of the utility to provide for removal or relocation of such utility facilities. Nothing in this Article 4.3.5 shall be deemed to require the District to indicate the presence of existing service laterals or appurtenances whenever the presence of such utilities on the Site can be inferred from the presence of other visible facilities, such as buildings, meters and junction boxes, on or adjacent to the Site. If such utility facilities are owned by a public utility, the public utility shall have the sole discretion to perform repairs or relocation work or permit the Contractor to do such repairs or relocation work at a reasonable price.

4.3.6 Conferences and Meetings. A material obligation of the Contractor under the Contract Documents is the attendance at meetings and conferences relating to the Work by the Contractor's supervisory personnel for the Work and the Contractor's management personnel as required by the Contract Documents or as requested by the District. The Contractor's personnel participating in conferences and meetings relating to the Work shall be authorized to act on behalf of the Contractor and to bind the Contractor. The Contractor is solely responsible for arranging for the attendance by Subcontractors, Material Suppliers at meetings and conferences relating to the Work as necessary, appropriate or as requested by the District.

4.3.6.1 Pre-Construction Conference. The Contractor's representatives (and representatives of Subcontractors as requested by the District) shall attend a Pre-Construction Conference at such time and place as designated by the District. The Pre-Construction Conference will address items such as the Contractor's access to the Site, review of construction procedures and requirements and other matters pertaining generally to construction of the Work.

4.3.6.2 Progress Meetings. Progress meetings will be conducted on regular intervals (weekly unless otherwise expressly indicated elsewhere in the Contract Documents). The Contractor's representatives and representatives of Subcontractors (as requested by the District) shall attend Progress Meetings. Progress Meetings will be chaired by the Architect or the Construction Manager and will generally include as agenda items: Site safety, field issues, coordination of Work, construction progress and impacts to timely completion, if any. The purposes of the Progress Meetings include without limitation: a formal and regular forum for discussion of the status and progress of the Work by all Project participants, a review of progress or resolution of previously raised issues and action items assigned to the Project participants, and reviews of the Construction

Schedule and Submittals.

4.3.6.3 Pre-Installation Conference. The Contractor's representatives (and representatives of Subcontractors as requested by the District or the Construction Manager) shall attend a Pre-Installation Conference prior to the initiation of a new phase of Work or in connection with the delivery and installation of major items of equipment incorporated into the Work. Pre-Installation Conferences will generally address the requirements of the new phase of Work and Contract Documents, and/or to coordinate delivery and installation of major equipment items.

4.3.6.4 Special Meetings. As deemed necessary or appropriate by the District, Special Meetings will be conducted with the participation of the Contractor, Subcontractors and other Project participants as requested by the District.

4.3.6.5 Minutes of Meetings. Following conclusion of the Pre-Construction Conference, Progress Meetings and Special Meetings, the Architect or the Construction Manager will prepare and distribute minutes reflecting the items addressed and actions taken at a meeting or conference. Unless the Contractor notifies the Architect or the Construction Manager in writing of objections or corrections to minutes prepared hereunder within five (5) days of the date of distribution of the minutes, the minutes as distributed shall constitute the official record of the meeting or conference. No objections or corrections of any Subcontractor or Material Supplier shall be submitted directly to the Architect or the Construction Manager; such objections or corrections shall be submitted to the Architect and the Construction Manager through the Contractor. If the Contractor timely interposes objections or notes corrections, the resolution of such matters shall be addressed at the next scheduled Progress Meeting.

4.4 Labor and Materials.

4.4.1 Payment for Labor, Materials and Services. Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, Construction Equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated in the Work.

4.4.2 Employee Discipline. The Contractor shall enforce strict discipline and good order among the Contractor's employees, the employees of any Subcontractor or Sub-subcontractor, and all other persons performing any part of the Work at the Site. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them. The Contractor shall dismiss from its employ and direct any Subcontractor or Sub-subcontractor to dismiss from their employment any person deemed by the District to be unfit or incompetent to perform Work and thereafter, the Contractor shall not employ nor permit the employment of such person for performance of any part of the Work without the prior written consent of the District, which consent may be withheld in the reasonable discretion of the District.

4.4.3 Compliance with Immigration Reform and Control Act of 1986. The Contractor is solely and exclusively responsible for employment of individuals for the Work of the Contract in conformity with the Immigration Reform and Control Act of 1986, 8 USC §§1101 et seq. (the "IRCA"); the Contractor shall also require Subcontractors and any other person or entity employing labor in connection with any of the Work to so similarly comply with the IRCA. The foregoing includes without limitation, verification that individuals engaged in any Work are legally entitled to do so.

4.4.4 Contractor's Project Manager and Superintendent

4.4.4.1 Qualifications of Contractor Superintendent and Contractor Project Manager. Prior to start of Work at the Site, the Contractor shall submit in writing to the District and Construction Manager, the qualifications of the Contractor's proposed superintendent ("Contractor Superintendent") and the Contractor's proposed Project Manager ("Contractor PM") for acceptance by the Construction Manager and District. The Contractor's proposed Contractor Superintendent and proposed Contractor PM shall each have recent experience in similar types of construction to the Work. The Contractor's proposed Contractor Superintendent and Contractor PM shall be satisfactory to the District and Construction Manager and shall not be changed during the Work unless the Contractor's employment of the Contractor Superintendent or Contractor PM is terminated by the Contractor for cause or the Contractor Superintendent or Contractor PM voluntary ceases employment by the Contractor. The Contractor shall dismiss the Contractor Superintendent or the Contractor PM if they are deemed, in the sole reasonable judgment of the District, to be unfit, incompetent or incapable of performing the functions assigned to them. In such event, the District shall have the right to approve of the replacement Contractor Superintendent or Contractor Project Manager, as applicable.

4.4.4.2 Contractor Superintendent. Competency of the Contractor Superintendent shall include, without limitation, a minimum of three (3) years prior experience as a superintendent for a general contractor on projects similar in size, scope and complexity to the Work. The Contractor's communications relating to the Work or the Contract Documents shall be through the Contractor Superintendent. The Contractor Superintendent shall represent the Contractor and communications given to the Contractor Superintendent shall be binding as if given to the Contractor.

4.4.4.3 Contractor Project Manager. The Contractor shall employ a Contractor PM who shall be a senior management employee of the Contractor. The Contractor PM shall be at the Site periodically to observe the progress and quality of the Work in progress and in place. The Contractor PM shall be responsible for directing and coordinating human and material resources of the Contractor and Subcontractors throughout the course of the Work using management techniques so that the Work is completed for the Contract Price and within the Contract Time.

4.5 Prohibition on Harassment.

4.5.1 District's Policy Prohibiting Harassment. The District is committed to providing a campus and workplace free of sexual harassment and harassment based on factors such as race, color religion, national origin, ancestry, age, medical condition, marital status, disability, veteran status or other legally protected classification. Harassment includes without limitation, verbal, physical or visual conduct which creates an intimidating, offensive or hostile environment such as racial slurs; ethnic jokes; posting of offensive statements, posters or cartoons or similar conduct. Sexual harassment includes without limitation the solicitation of sexual favors, unwelcome sexual advances, or other verbal, visual or physical conduct of a sexual nature.

4.5.1.1 Contractor's Adoption of Anti-Harassment Policy. Contractor shall adopt and implement all appropriate and necessary policies prohibiting any form of discrimination in the workplace, including without limitation harassment on the basis of any classification protected under local, state or federal law, regulation or policy. Contractor shall take all reasonable steps to prevent harassment from occurring, including without limitation affirmatively raising the subject of

harassment among its employees, expressing strong disapproval of any form of harassment, developing appropriate sanctions, informing employees of their right to raise and how to raise the issue of harassment and informing complainants of the outcome of an investigation into a harassment claim. Contractor shall require that any Subcontractor or Sub-subcontractor performing any portion of the Work to adopt and implement policies in conformity with this Article 4.4.5.

4.5.1.2 Prohibition on Harassment at the Site. Contractor shall not permit any person, whether employed by Contractor, a Subcontractor, or any other person or entity, performing any Work at or about the Site to engage in any prohibited form of harassment. Any such person engaging in a prohibited form of harassment directed to any individual performing or providing any portion of the Work at or about the Site shall be subject to appropriate sanctions in accordance with the anti-harassment policy adopted and implemented pursuant to Article 4.4.5.1 above. Any person, performing or providing Work on or about the Site engaging in a prohibited form of harassment directed to any student, faculty member or staff of the District or directed to any other person on or about the Site shall be subject to immediate removal and shall be prohibited thereafter from providing or performing any portion of the Work. Upon the District's receipt of any notice or complaint that any person employed directly or indirectly by Contractor in performing or providing the Work has engaged in a prohibited form of harassment, the District will promptly undertake an investigation of such notice or complaint. If the District, after such investigation, reasonably determines that a prohibited form of harassment has occurred, the District shall promptly notify the Contractor of the same and direct that the person engaging in such conduct be immediately removed from the Site. Unless the District's determination that a prohibited form of harassment has occurred is grossly negligent or without reasonable cause, District shall have no liability for directing the removal of any person determined to have engaged in a prohibited form of harassment nor shall the Contract Price or the Contract Time be adjusted on account thereof. Contractor and the Surety shall defend, indemnify and hold harmless the District and its employees, officers, board of trustees, agents, and representatives from any and all claims, liabilities, judgments, awards, actions or causes of actions, including without limitation, attorneys' fees, which arise out of, or pertain in any manner to: (i) the assertion by any person dismissed from performing or providing work at the direction of the District pursuant to this Article 4.4.5.2; or (ii) the assertion by any person that any person directly or indirectly under the employment or direction of the Contractor has engaged in a prohibited form of harassment directed to or affecting such person. The obligations of the Contractor and the Surety under the preceding sentence are in addition to, and not in lieu of, any other obligation of defense, indemnity and hold harmless whether arising under the Contract Documents, at law or otherwise; these obligations survive completion of the Work or the termination of the Contract.

4.6 Taxes. The Contractor shall pay, without adjustment of the Contract Price, all sales, consumer, use and other taxes for the Work or portions thereof provided by the Contractor under the Contract Documents.

4.7 Permits, Fees and Notices; Compliance With Laws.

4.7.1 Payment of Permits, Fees. The Contractor shall secure and pay for permits, approvals governmental fees, licenses and inspections necessary or required for the proper execution and completion of the Work which are designated in the Contract Documents as the responsibility of the Contractor.

4.7.2 Compliance With Laws. The Contractor shall comply with and give notices required by the Laws and other orders of public authorities bearing on performance of the Work.

4.7.3 Notice of Variation From Laws. If the Contractor knows, or has reason to believe, that any portion of the Contract Documents are at variance with the Laws, the Contractor shall promptly notify the Architect, Construction Manager and the Project Inspector, in writing, of the same. If the Contractor performs Work knowing, or with reasonable diligence should have known, it to be contrary to the Laws without such notice to the Architect, Construction Manager and the Project Inspector, the Contractor shall assume full responsibility for such Work and shall bear the attributable costs arising or associated therefrom, including without limitation, the removal, replacement or correction of the same.

4.8 Submittals.

4.8.1 Purpose of Submittals. Submittals are not Contract Documents. Submittals are for the purpose of demonstrating, for those portions of the Work for which Submittals are required, the manner in which the Contractor proposes to provide or incorporate such item of the Work in conformity with the information given and the design concept expressed in the Contract Documents.

4.8.2 Contractor's Submittals.

4.8.2.1 Prompt Submittals. The Contractor shall review, approve and submit to the Architect or such other person or entity designated by the District or the Contract Documents, the number of copies of Submittals required by the Contract Documents. All Submittals required by the Contract Documents shall be prepared, assembled and submitted by the Contractor within the time frames set forth in the Submittal Schedule incorporated and made a part of the Approved Construction Schedule. Contractor's submission of Submittals in conformity with the Submittal Schedule is a material obligation of the Contractor. If the Contractor fails or refuses to deliver Submittals in accordance with the Submittal Schedule, the Contractor shall be subject to per diem assessments in the amount set forth in the Special Conditions for each day of delayed submission for any Submittal beyond the date set forth in the Submittal Schedule for Contractor's submission of such Submittal. Contractor and the District acknowledge and agree that the per diem assessment for delayed submission of Submittals set forth in the Special Conditions represents a reasonable estimate of costs and expenses the District will incur as a result of delayed submission of Submittals and that the same is not a penalty. Notwithstanding Contractor's submission of all required Submittals in accordance with the Submittal Schedule, in the event that the District or the Architect reasonably determines that all or any portion of such Submittals fail to comply with the requirements of Articles 4.7.2.2, 4.7.2.3 and 4.7.2.4 of these General Conditions and/or such Submittals are not otherwise complete and accurate so as to require re-submission, Contractor shall bear all costs associated with the review and approval of resubmitted Submittals, including without limitation Architect's fees incurred in connection therewith; provided that such costs are in addition to, and not in lieu of, Liquidated Damages imposed under this Article 4.7.2.1 for Contractor's delayed submission of Submittals. If Liquidated Damages are assessed for the Contractor's delayed submission of Submittals or if the Contractor is assessed Architect fees to review incomplete or inaccurate Submittals, the District may deduct the same from any portion the Contract Price then or thereafter due the Contractor. Submittals not required by the Contract Documents or which do not otherwise conform to the requirements of the Contract Documents may be returned without action. No

adjustment to the Contract Time or the Contract Price shall be granted to the Contractor on account of its failure to timely submit of any Submittal.

4.8.2.2 Approval of Subcontractor Submittals. All Submittals prepared by Subcontractors, Material Suppliers, manufacturers or distributors shall bear the written approval of the Contractor thereto prior to submission to the Architect for review. Any Submittal not bearing the Contractor's written approval shall be subject to return to the Contractor for re-submittal in conformity herewith, with the same being deemed to not have been submitted. Any delay, impact or cost associated therewith shall be the sole and exclusive responsibility of the Contractor without adjustment to the Contract Time or the Contract Price.

4.8.2.3 Verification of Submittal Information. By approving and submission of Submittals, the Contractor represents to the District and Architect that the Contractor has determined and verified materials, field measurements, field construction criteria, catalog numbers and similar data related thereto and has checked and coordinated the information contained within such Submittals with the requirements of the Work and of the Contract Documents.

4.8.2.4 Information Included in Submittals. All Submittals shall be accompanied by a written transmittal or other writing by the Contractor providing an identification of the portion of the Drawings or the Specifications pertaining to the Submittal, with each Submittal numbered consecutively for ease of reference along with the following information: (i) date of submission; (ii) project name; (iii) name of submitting Subcontractor; and (iv) if applicable, the revision number. The foregoing information is in addition to, and not in lieu of, any other information required by the Contract Documents for the Architect's review, evaluation and acceptance of the Contractor's Submittals.

4.8.2.5 Contractor Responsibility for Deviations. The Contractor shall not be relieved of responsibility for correcting deviations from the requirements of the Contract Documents by the Architect's review of Submittals unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submission of the Submittal and the Architect has given written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Submittals by the Architect's review thereof.

4.8.2.6 No Performance of Work Without Architect Review. The Contractor shall perform no portion of the Work requiring the Architect's review of Submittals until the Architect has completed its review and returned the Submittal to the Contractor indicating "No Exception Taken" to such Submittal. The Contractor shall not perform any portion of the Work forming a part of a Submittal or which is affected by a related Submittal until the entirety of the Submittal or other related Submittal has been fully processed. Such Work shall be in accordance with the final action taken by the Architect in review of Submittals and other applicable portions of the Contract Documents.

4.8.3 Architect Review of Submittals. The purpose of the Architect's review of Submittals and the time for the Architect's return of Submittals to the Contractor shall be as set forth elsewhere in the Contract Documents. If the Architect returns a Submittal as rejected or requiring correction(s) with re-submission, the Contractor, so as not to delay the progress of the Work, shall promptly thereafter resubmit a Submittal conforming to the requirements of the Contract Documents; the resubmitted Submittal shall indicate the portions thereof modified in accordance with the Architect's direction. When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, the Architect shall be entitled to rely upon the accuracy and completeness of such calculations and certifications accompanying Submittals. The Architect's review of the Submittals is for the limited

purposes described in the Contract Documents. The following notations or notations of a similar nature noted on a reviewed Submittal will require the Contractor action noted below.

Notation	Action Required
No Exceptions Taken	No formal revision required
Make Corrections Noted	Make revision noted; re-submission of revised Submittal not required
Revise and Re-Submit	Revise Submittal in accordance with notations and re-submit for revision
Rejected Re-Submit	Prepare new alternative Submittal and re-submit for review

4.8.4 Deferred Approval Items. If any portion of the Work is designated in the Contract Documents as a "Deferred Approval" item, Contractor shall be solely and exclusively responsible for: (i) the design, engineering and specifying the materials/equipment forming any part of the Deferred Approval Item; (ii) integrating and/or coordinating the Deferred Approval Item with other portions of the Work; (iii) preparation of Submittals for such item(s) in a timely manner so as not to delay or hinder the completion of the Work within the Contract Time; and (iv) timely obtaining DSA approval thereof.

4.9 Materials and Equipment.

4.9.1 Specified Materials, Equipment. References in the Contract Documents to any specific article, device, equipment, product, material, fixture, patented process, form, method or type of construction, by name, make, trade name, or catalog number, with or without the words "or equal" shall be deemed to establish a minimum standard of quality or performance, and shall not be construed as limiting competition.

4.9.2 Approval of Substitutions or Alternatives. The Contractor may propose to furnish alternatives or substitutes for a particular item specified in the Contract Documents, provided that: (i) such proposed substitution or alternative complies with the requirements of the Specifications relating to substitutions of specified items; (ii) the Contractor certifies to the Architect and District that the quality, performance capability and functionality (including visual and/or aesthetic effect) of the proposed alternative or substitute meet or exceed the quality, performance capability and functionality of the item or process specified; and (iii) demonstrate to the reasonable satisfaction of the Architect and District that the use of the substitution or alternative is appropriate and will not delay completion of the Work or result in an increase to the Contract Price. The Contractor shall submit calculations engineering, construction, dimension, visual, aesthetic and performance data to the Architect to permit its proper evaluation of the proposed substitution or alternative. If requested by the Architect, Contractor shall promptly furnish any additional information or data regarding a proposed substitution or alternative which the Architect deems reasonably necessary for the evaluation of the proposed substitution or alternative. The Contractor shall not provide, furnish or install any substitution or alternative without the Architect's review and final action on the proposed substitution or alternative; any alternative or substitution installed or incorporated into the Work without first obtaining the Architect's review and final action of the same shall be subject to removal pursuant to Article 12 hereof. The Architect's decision evaluating the Contractor's proposed substitutions or alternatives shall be final. Neither the Contract Time nor the Contract Price shall be increased on account of any substitution or alternative proposed by the Contractor and which is accepted by the Architect; provided, however, that in the event a substitution or alternative accepted by the Architect and purchase, fabrication and/or installation or such accepted substitution or alternative shall

be less expensive than the originally specified item, the Contract Price shall be reduced by the actual cost savings realized by the Contractor's furnishing and/or installation of such approved substitution or alternative. The Contractor shall be solely responsible for all costs and fees incurred by the District to review a proposed substitution or alternative, including without limitation fees of the Architect, and/or governmental agencies including submittal to DSA if required to review and/or approve any proposed substitution or alternative. The Contractor shall be solely responsible for any increase in the cost of any accepted substitution or alternative or any Work affected by such alternative or substitution. The foregoing notwithstanding, all requests for the Architect's review and approval of any proposed substitution or alternative and all engineering, construction, dimension and performance data substantiating the equivalency of the proposed substitution or alternative shall be submitted by Contractor not later than thirty-five (35) days following the date of the District's award of the Contract to Contractor by action of the District's Board of Trustees; any request for approval of proposed alternatives or substitutions submitted thereafter may be rejected summarily. The foregoing process and time limits shall apply to any proposed substitution or alternative regardless of whether the substitute or alternate item is to be provided, furnished or installed by Contractor, any Subcontractor, any Sub-Subcontractor, Material Supplier or Manufacturer.

4.9.3 "Sole Source" Products. If any material, equipment, or other item is identified in the Contract Documents as being the only source of the material, equipment or other item necessary to accomplish the intended result(s), such material, equipment or other item shall not be subject to substitution.

4.9.4 Placement of Material and Equipment Orders. Contractor shall, after award of the Contract, promptly and timely place all orders for materials and/or equipment necessary for completion of the Work so that delivery of the same shall be made without delay or interruption to the timely completion of the Work. Contractor shall require that any Subcontractor similarly place orders for all materials and/or equipment to be furnished by any such Subcontractor in a prompt and timely manner so that delivery of the same shall be made without delay or interruption to the timely completion of the Work. Upon request of the District, Construction Manager or the Architect, the Contractor shall furnish reasonably satisfactory written evidence of the placement of orders for materials and/or equipment necessary for completion of the Work, including without limitation, orders for materials and/or equipment to be provided, furnished or installed by any Subcontractor.

4.9.5 District's Right to Place Orders for Materials and/or Equipment. Notwithstanding any other provision of the Contract Documents, if the Contractor shall, upon request of the District, Construction Manager or the Architect, fails or refuses, for any reason, to provide reasonably satisfactory written evidence of the placement of orders for materials and/or equipment necessary for completion of the Work, or should the District determine, in its sole and reasonable discretion, that any orders for materials and/or equipment have not been placed in a manner so that such materials and/or equipment will be delivered to the Site so the Work can be completed without delay or interruption, the District shall have the right, but not the obligation, to place such orders on behalf of the Contractor. If the District exercises the right to place orders for materials and/or equipment pursuant to the foregoing, the District's conduct shall not be deemed to be an exercise, by the District, of any control over the means, methods, techniques, sequences or procedures for completion of the Work, all of which remain the responsibility and obligation of the Contractor. Notwithstanding the right of the District to place orders for materials and/or equipment pursuant to the foregoing, the election of the District to exercise, or not to exercise, such right shall not relieve the Contractor from any of Contractor's obligations under the Contract Documents, including without limitation, completion of the Work

within the Contract Time and for the Contract Price. If the District exercises the right hereunder to place orders for materials and/or equipment on behalf of Contractor pursuant to the foregoing, Contractor shall reimburse the District for all costs and fees incurred by the District in placing such orders; such costs and fees may be deducted by the District from the Contract Price then or thereafter due the Contractor.

4.9.6 Contractor and Subcontractor Communication. All written communications between the Contractor and any Subcontractor, Material Supplier or others directly or indirectly engaged by the Contractor to perform or provide any portion of the Work shall be available to the District, the Construction Manager and the Architect for review, inspection and reproduction as may be requested from time to time. The foregoing is a material obligation of the Contractor hereunder.

4.10 Safety.

4.10.1 OCIP Safety Requirements. In addition to other provisions of the Contract Documents relating to Safety at the Site, the Contractor shall comply with the safety requirements mandated by, or associated with, the OCIP set forth in the OCIP Program description incorporated as Attachment D to the Special Conditions.

4.10.2 Safety Programs. The Contractor shall be solely responsible for initiating, maintaining and supervising all safety programs required by the Laws required by the type or nature of the Work. The foregoing include, without limitation: (i) workplace safety programs mandated by the Laws; and (ii) safety programs and safety measures required by the OSHA, including without limitation, compliance with the California Drug Free Workplace Act of 1990 (California Government Code §§8350 et seq.). Without limiting or relieving the Contractor of its obligations hereunder, the Contractor shall require that its Subcontractors similarly initiate and maintain all appropriate or required safety programs.

4.10.3 Contractor Safety Plan. Prior to commencement of Work at the Site, the Contractor shall submit to the District and the Construction Manager, if any, the Contractor's Safety Plan for the Work for review and acceptance by the District. Acceptance by the District is subject to the Safety Plan conforming to requirements of the Laws, conditions at or about the Site and the nature of the Work. The Contractor shall modify its Safety Plan as necessary to obtain the District's acceptance thereof. Notwithstanding the District's acceptance of the Contractor's Safety Plan, the Contractor shall remain solely responsible for implementing the Safety Plan and implementing measures as necessary to maintain safety of persons and property at and about the Site. The District's acceptance of the Contractor's Safety Plan shall not limit, restrict or otherwise modify the Contractor's obligations relating to safety at or about the Site in accordance with the Contract Documents and the Laws.

4.10.4 Safety Precautions. The Contractor shall be solely responsible for initiating and maintaining reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to: (i) employees on the Work and other persons who may be affected thereby; (ii) the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site, under care, custody or control of the Contractor or Subcontractors; and (iii) other property or items at the Site, or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement.

4.10.5 Safety Signs, Barricades. The Contractor shall erect and maintain, as required by existing conditions and conditions resulting from performance of the Contract, reasonable safeguards for safety and protection of property and persons, including, without limitation, posting danger signs and other warnings against hazards, barricades, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

4.10.6 Safety Notices. The Contractor shall give or post all safety notices required by the Laws and comply with the Laws bearing on safety of persons or property or their protection from damage, injury or loss.

4.10.7 Safety Coordinator. The Contractor shall designate a responsible member of the Contractor's organization at the Site whose duty shall be the prevention of accidents and the implementation and maintenance safety precautions and programs. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Construction Manager, Project Inspector and the Architect.

4.10.8 Emergencies. In an emergency affecting safety of persons or property, the Contractor shall act, to prevent threatened damage, injury or loss.

4.10.9 Hazardous Materials.

4.10.9.1 General. If the Contractor, any Subcontractor or anyone employed directly or indirectly by them shall use, at the Site, or incorporate into the Work, any material or substance deemed to be hazardous or toxic under any law, rule, ordinance, regulation or interpretation thereof (collectively "Hazardous Materials"), the Contractor shall comply with all Laws applicable thereto and shall exercise all necessary safety precautions relating to the use, storage or disposal thereof.

4.10.9.2 Prohibition on Use of Asbestos Construction Building Materials ("ACBMs"). Notwithstanding any provision of the Drawings or the Specifications to the contrary, it is the intent of the District that ACBMs not be used or incorporated into any portion of the Work. In the event that any portion of the Work depicted in the Drawings or the Specifications shall require materials or products which the Contractor knows, or should have known with reasonably diligent investigation, to contain ACBMs, Contractor shall promptly notify the Architect and the Project Inspector of the same so that an appropriate alternative can be made in a timely manner so as not to delay the progress of the Work. Contractor warrants to the District that there are no materials or products used or incorporated into the Work which contain ACBMs. Whether before or after completion of the Work, if it is discovered that any product or material forming a part of the Work or incorporated into the Work contains ACBMs, the Contractor shall at its sole cost and expense remove such product or material in accordance with any laws, rules, procedures and regulations applicable to the handling, removal and disposal of ACBMs and to replace such product or material with non-ACBM products or materials and to return the affected portion(s) of the Work to the finish condition depicted in the Drawings and Specifications relating to such portion(s) of the Work. Contractor's obligations under the preceding sentence shall survive the termination of the Contract, the warranty period provided under the Contract Documents, the Contractor's completion of the Work or the District's acceptance of the Work. If the Contractor fails or refuses, for any reason, to commence the removal and replacement of any material or product containing ACBMs forming a part of, or incorporated into the Work, within ten (10) days of the date of the District's written notice to the Contractor of the existence of ACBM materials or products in the Work, the District may thereafter proceed to cause the removal and replacement of such materials or products in any manner which the District determines to be reasonably necessary and appropriate; all costs, expenses and fees, including without limitation fees and costs of consultants and attorneys, incurred by the District in connection with such removal and replacement shall be the responsibility of the Contractor and the Surety.

4.10.9.3 Disposal of Hazardous Materials. Contractor shall be solely and exclusively responsible for the disposal of any Hazardous Materials on or about the Site. The Contractor's obligations hereunder shall include without limitation,

the transportation and disposal of any Hazardous Materials in strict conformity with the Laws.

4.10.10 Temporary Sanitary Facilities. At all times during Work at the Site, the Contractor shall obtain and maintain temporary sanitary facilities in conformity with applicable law, rule or regulation. The Contractor shall maintain temporary sanitary facilities in a neat and clean manner with sufficient toilet room supplies. Personnel engaged in the Work are not permitted to use toilet facilities at or about the Site.

4.10.11 Noise and Dust Control

4.10.11.1 Noise Control. The Contractor shall install noise reducing devices on construction equipment. Contractor shall comply with the requirements of the city and county having jurisdiction with regard to noise ordinances governing construction sites and activities. Construction Equipment noise at the Site shall be limited and only as permitted by applicable law, rule or regulation. If classes are in session at any point during the progress of the Work, and, in the District's reasonable discretion, the noise from any Work disrupts or disturbs the students or faculty or the normal operation of the college, at the District's request, the Contractor shall schedule the performance of all such Work around normal college hours or make other arrangements so that the Work does not cause such disruption or disturbance. In no event shall such arrangements result in adjustment of the Contract Price or the Contract Time.

4.10.11.2 Dust Control. The Contractor shall be fully and solely responsible for maintaining and up keeping all areas of the Site and adjoining areas, outdoors and indoors, free from flying debris, grinding powder, sawdust, dirt and dust as well as any other product, product waste or work waste, that by becoming airborne may cause respiratory inconveniences to persons, particularly to students and District personnel. Additionally, the Contractor shall take specific care to avoid deposits of airborne dust or airborne elements. Such protection devices, systems or methods shall be in accordance with the Laws, including, without limitation, the EPA, OSHA and Cal-OSHA,. Additionally, the Contractor shall be the sole party responsible to regularly and routinely clean up and remove any and all deposits of dust and other elements. Damage and/or any liability derived from the Contractor's failure to comply with these requirements shall be exclusively at the cost of the Contractor, including, without limitation, any and all penalties that may be incurred for violations of applicable law, rule or regulation, and any amounts expended by the District to pay such damages shall be due and payable to the District on demand. Contractor shall replace any damaged property or part thereof and professionally clean any and all items that become covered or partially covered to any degree by dust or other airborne elements. If classes are in session at any point during the progress of Work, and, in the District's reasonable discretion, flying debris, grinding powder, sawdust, dirt or dust from any Work disrupts or disturbs the students or faculty or the normal operation of the college, at the District's request, the Contractor shall schedule the performance of all such Work around normal college hours and make other arrangements so that the Work does not cause such disruption or disturbance. In no event shall such arrangements result in adjustment of the Contract Price or the Contract Time.

4.10.11.3 Air Pollution. The Contractor shall comply with all applicable air pollution control rules, regulations, ordinances, or statutes. Neither the Contract Time nor the Contract Price shall be subject to adjustment for measures of the Contractor to comply with air pollution control requirements. The Contractor shall be solely responsible for implementing measures required by any governmental or quasi-governmental agency with jurisdiction and/or authority to enforce air

pollution control measures without adjustment of the Contract Time or the Contract Price. If in performance of the Work, the Contractor violates applicable air pollution control requirements, the Contractor shall be solely responsible for discharging and satisfying any fine, penalty or remedial measure imposed by a governmental or quasi-governmental agency with authority or jurisdiction to enforce air pollution control measures. The scope of the Contractor's indemnity obligations under the Contract Documents shall include, without limitation, the defense, indemnity and hold harmless of the Indemnified Parties from any fine, penalty or remedial measure imposed by a governmental or quasi-governmental agency with authority or jurisdiction to enforce air pollution control measures as a result of the Contractor's failure or refusal to comply with its obligations hereunder.

4.10.11.4 Contractor Failure to Comply. If the Contractor fails to comply with the requirements for dust control, noise control, or any other maintenance or clean up requirement of the Contract Documents, the District, Architect, District Inspector or Construction Manager are each authorized to notify the Contractor in writing of such failure and the Contractor shall take immediate action. Should the Contractor fail to respond with immediate and responsive action and not later than twenty-four (24) hours from such notification, the District shall have the absolute right to proceed as it may deem necessary to remedy such matter. Any and all costs incurred by the District in connection with such actions shall be the sole responsibility of, and be borne by, the Contractor; the District may deduct such amounts from the Contract Price then or thereafter due the Contractor.

4.11 Maintenance of Documents.

4.11.1 Documents at Site. The Contractor shall maintain at the Site: (i) one record copy of the Drawings, Specifications and all addenda thereto; (ii) Change Orders approved by the District and all other modifications to the Contract Documents; (iii) Submittals reviewed by the Architect; (iv) Record Drawings; (v) Material Safety Data Sheets ("MSDS") accompanying any materials, equipment or products delivered or stored at the Site or incorporated into the Work; and (vi) all building and other codes or regulations applicable to the Work, including without limitation, Title 24, Part 2 of the California Code of Regulations. During performance of the Work, all documents maintained by Contractor at the Site shall be available to the District, the Construction Manager, the Architect, the Project Inspector and DSA for review, inspection or reproduction. Upon completion of the Work, all documents maintained at the Site by the Contractor pursuant to the foregoing shall be assembled and transmitted to the Architect for delivery to the District.

4.11.2 Maintenance of Record Drawings. During its performance of the Work, the Contractor shall maintain Record Drawings consisting of a set of the Drawings which are marked to indicate all field changes made to adapt the Work depicted in the Drawings to field conditions, changes resulting from Change Orders and all concealed or buried installations, including without limitation, piping, conduit and utility services. All buried or concealed items of Work shall be completely and accurately marked and located on the Record Drawings. The Record Drawings shall be clean and all changes, corrections and dimensions shall be marked in a neat and legible manner in a contrasting color. Record Drawings relating to the Structural, Mechanical, Electrical and Plumbing portions of the Work shall indicate without limitation, circuiting, wiring sizes, equipment/member sizing and shall depict the entirety of the as built conditions of such portions of the Work. The Record Drawings shall be continuously maintained by the Contractor during the performance of the Work. At any time during the Contractor's performance of the Work, upon the request of the District, the Project Inspector or the Architect, the Contractor

shall make the Record Drawings maintained here under available for the District's review and inspection. The District's review and inspection of the Record Drawings during the Contractor's performance of the Work shall be only for the purpose of generally verifying that Contractor is continuously maintaining the Record Drawings in a complete and accurate manner; any such inspection or review shall not be deemed to be the District's approval or verification of the completeness or accuracy thereof. The failure or refusal of the Contractor to continuously maintain complete and accurate Record Drawings or to make available the Record Drawings for inspection and review by the District may be deemed by the District to be Contractor's default of a material obligation hereunder. Without waiving, restricting or limiting any other right or remedy of the District for the Contractor's failure or refusal to continuously maintain the Record Drawings, the District may, upon reasonably determining that the Contractor has not, or is not, continuously maintaining the Record Drawings in a complete and accurate manner, take appropriate action to cause the continuous maintenance of complete and accurate Record Drawings, in which event all fees and costs incurred or associated with such action shall be charged to the Contractor and the District may deduct the amount of such fees and costs from any portion of the Contract Price then or thereafter due the Contractor. In accordance with Article 8.4.2 of these General Conditions, prior to receipt of the Final Payment, Contractor shall deliver the Record Drawings to the Architect.

4.11.3 Daily Reports By Contractor. At the end of each work day, the Contractor shall submit a daily report to the Construction Manager and the Project Inspector for document control listing all labor, materials, and equipment involved with the Work for that day, including but not limited to: (i) Labor, number of classifications of work by contractor/subcontractors, (ii) Materials used, by contractor/subcontractor, (iii) Equipment used, by contractor/subcontractors, (iv) Any inspections or testing performed, (v) Any other authorized services or expenditures.

4.12 Site.

4.12.1 Contractor Use of Site. The Contractor shall confine operations at the Site to areas permitted by the Laws or permits relating to the Work, subject to any restrictions or limitations set forth in the Contract Documents. The Contractor shall not unreasonably encumber the Site or adjoining areas with materials or equipment. The Contractor is solely responsible for providing security at the Site with all such costs included in the Contract Price. The District shall at all times have access to the Site.

4.12.2 Limitations Upon Site Activities. Except in the circumstances of an emergency, no construction activities shall be permitted at or about the Site except during the District's hours and days set forth in the Special Conditions. Work performed outside of the hours and days noted in the Special Conditions will not result in adjustment of the Contract Time or the Contract Price; unless Work outside of the hours and days noted in the Special Conditions is expressly authorized by the District. Additional or premium costs incurred by the District for Work performed outside the hours and days of Work permitted at the Site shall be borne solely and exclusively by the Contractor. The District may deduct such additional or premium costs from the Contract Price then or thereafter due the Contractor.

4.13 Clean-Up. The Contractor shall at all times keep the Site and all adjoining areas free from the accumulation of any waste material or rubbish caused or generated by performance of the Work. Without limiting the generality of the foregoing, Contractor shall maintain the Site in a "rake-clean" standard on a daily basis. If the Work includes painting and/or the installation of floor covering, before any painting operations or the installation of any flooring covering, the area and adjoining areas of the Site where paint is to be applied or floor covering is to be installed shall be in a "broom-clean" condition. Prior to completion of the Work, Contractor shall remove

from the Site all rubbish, waste materials, excess excavated materials, tools, Construction Equipment, machinery, surplus materials and any other items which are not the property of the District under the Contract Documents. Upon completion of the Work, the Site and all adjoining areas shall be left by the Contractor in a neat and broom clean condition satisfactory to District. The Project Inspector or Construction Manager shall be authorized to direct the Contractor's clean-up obligations hereunder. If the Contractor fails to clean up as provided for in the Contract Documents, the District may do so, and all costs incurred in connection therewith shall be charged to the Contractor; the District may deduct such costs from any portion of the Contract Price then or thereafter due the Contractor.

4.14 Access to the Work. The Contractor shall provide DSA, the District, the Construction Manager, the Project Inspector and the Architect access to the Work, whether in place, preparation and progress and wherever located.

4.15 Facilities and Information for the Project Inspector.

4.15.1 Information to Project Inspector. The Contractor shall furnish the Project Inspector access to the Work for obtaining such information as may be necessary to keep the Project Inspector fully informed respecting the progress, quality and character of the Work and materials, equipment or other items incorporated therein.

4.15.2 Facilities for Project Inspector. Facilities, services or other items to be provided by the Contractor for use by the Project Inspector, if any, shall be as set forth in the Special Conditions. If any such facilities, services or other items are designated in the Special Conditions and the Contractor fails or refuses to provide the same, the District may furnish such facilities, services or other items, with the costs, fees or expenses incurred to furnish the same being deducted from the Contract Price.

4.16 Patents and Royalties. The Contractor and the Surety shall defend, indemnify and hold harmless the District and its agents, employees and officers from any claim, demand or legal proceeding arising out of or pertaining, in any manner, to any actual or claimed infringement of patent rights in connection with performance of the Work.

4.17 Cutting and Patching. The Contractor is responsible for cutting, fitting or patching required to complete the Work or to make the component parts thereof fit together properly. The Contractor shall not damage or endanger any portion of the Work, or the fully or partially completed construction of the District or separate contractors by cutting, patching, excavation or other alteration. The Contractor shall not cut, patch or otherwise alter the construction by the District or separate contractor without the prior written consent of the District or separate contractor thereto, which consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold consent to the request of the District or separate contractor to cut, patch or otherwise alter the Work.

4.18 Encountering of Hazardous Materials. If the Contractor encounters Hazardous Materials at the Site which have not been rendered harmless or for which there is no provision in the Contract Documents for containment, removal, abatement or handling of such Hazardous Materials, the Contractor shall immediately stop the Work in the affected area, but shall diligently proceed with the Work in all other unaffected areas. Upon encountering such Hazardous Materials, the Contractor shall immediately notify the Project Inspector and the Architect, in writing, of such condition. The Contractor shall proceed with the Work in such affected area only after such Hazardous Materials have been rendered harmless, contained, removed or abated. If such Hazardous Materials are encountered, the Contractor shall be entitled to an adjustment of the Contract Time to the extent that the Work is stopped and Substantial Completion of the Work is affected thereby. In no event shall there be an adjustment to the

Contract Price solely on account of the Contractor encountering such Hazardous Materials.

4.19 Wage Rates; Employment of Labor.

4.19.1 Prevailing Wage Rates.

4.19.1.1 Prevailing Wage Rate Schedules. Pursuant to the provisions of Division 2, Part 7, Chapter 1, Article 2 of the California Labor Code at §§1770 et seq., the District has obtained from the Director of the Department of Industrial Relations the general prevailing rate of per diem wages and the prevailing rate for holiday and overtime work in the locality in which the Work is to be performed. Holidays shall be as defined in the collective bargaining agreement applicable to each particular craft, classification or type of worker employed under the Contract. Per diem wages include employer payments for health and welfare, pensions, vacation, travel time and subsistence pay as provided in California Labor Code §1773.8, apprenticeship or other training programs authorized by California Labor Code §3093, and similar purposes when the term "per diem wages" is used herein. Holiday and overtime work, when permitted by law, shall be paid for at the rate of at least one and one-half (1½) times the above specified rate of per diem wages, unless otherwise specified. The Contractor shall post, at appropriate and conspicuous locations on the Site, a schedule showing all determined general prevailing wage rates.

4.19.1.2 Payment of Prevailing Rates. There shall be paid each worker of the Contractor and Subcontractors, of any tier, engaged in the Work, not less than the general prevailing wage rate, regardless of any contractual relationship which may be alleged to exist between the Contractor or any Subcontractor, of any tier, and such worker.

4.19.1.3 Prevailing Rate Penalty. The Contractor shall, as a penalty, forfeit not more than Two Hundred Dollars ($200.00) to the District for each calendar day or portion thereof, for each worker paid less than the prevailing rates for such work or craft in which such worker is employed for the Work by the Contractor or by any Subcontractor, of any tier, in connection with the Work. The amount of the penalty for failure to pay applicable prevailing wage rates shall be determined and assessed in accordance with the standards established pursuant to Labor Code §1775(a)(2). The amount of the penalty shall be determined based on consideration of both of the following: (i) whether the failure of the Contractor or Subcontractor to pay the correct rate of per diem wages was a good faith mistake and, if so, the error was promptly and voluntarily corrected when brought to the attention of the Contractor or Subcontractor; and (ii) whether the Contractor or Subcontractor has a prior record of failing to meet its prevailing wage obligations. The penalty may not be less than forty dollars ($40) for each calendar day, or portion thereof, for each worker paid less than the prevailing wage rate, unless the failure of the Contractor or Subcontractor to pay the correct rate of per diem wages was a good faith mistake and, if so, the error was promptly and voluntarily corrected when brought to the attention of the contractor or subcontractor. The penalty may not be less than eighty dollars ($80) for each calendar day, or portion thereof, for each worker paid less than the prevailing wage rate, if the Contractor or Subcontractor has been assessed penalties within the previous three years for failing to meet its prevailing wage obligations on a separate contract, unless those penalties were subsequently withdrawn or overturned. The penalty may not be less than one hundred twenty dollars ($120) for each calendar day, or portion thereof, for each worker paid less than the prevailing wage rate, if the Labor Commissioner determines that the violation was willful, as defined in subdivision (c) of Section 1777.1. When the penalty amount due hereunder is

collected from the Contractor or Subcontractor, any outstanding wage claim under Chapter 1 (commencing with Section 1720) of Part 7 of Division 2 against that Contractor or Subcontractor shall be satisfied before applying that amount to the penalty imposed on that Contractor or Subcontractor hereunder. The difference between prevailing wage rates and the amount paid to each worker each calendar day, or portion thereof, for which each worker paid less than the prevailing wage rate, shall be paid to each worker by the Contractor.

4.19.1.4 Prevailing Wage Rate Monitoring and Enforcement. During the Work and pursuant to Labor Code §1771.4(a)(4), the Department of Industrial Relations shall monitor and enforce the obligation of the Contractor and Subcontractors of every tier to pay laborers performing any portion of the Work the Prevailing Wage Rate established for the classification of work/labor performed.

4.19.2 Payroll Records.

4.19.2.1 Certified Payroll Records. Pursuant to California Labor Code §1776, the Contractor and each Subcontractor, of any tier, shall keep an accurate payroll record, showing the name, address, social security number, work classification, straight time and overtime hours worked each day and week, and the actual per diem wages paid to each person employed for the Work.

4.19.2.2 Certified Payroll Records Submittal to Labor Commissioner. The Contractor and all Subcontractors shall prepare and submit Certified Payroll Records to the Labor Commissioner in compliance with requirements established in Labor Code §1771.4. The form and content of Certified Payroll Records shall be as established by the Labor Commissioner and the frequency of Certified Payroll Records submittal to the Labor Commissioner shall be pursuant to Labor Code §1771.4.

4.19.2.3 Inspection and Copies of Certified Payroll Records**.** The payroll records shall be certified and available for inspection at all reasonable hours at the principal office of the Contractor on the following basis: (i) a certified copy of an employee's payroll record shall be made available for inspection or furnished to such employee or his/her authorized representative on request; (ii) a certified copy of all payroll records shall be made available for inspection or furnished upon request to the District, the Division of Labor Standards Enforcement ("DLSE") and the Division of Apprenticeship Standards of the Department of Industrial Relations ("Apprenticeship Council"); (iii) a certified copy of payroll records shall be made available upon request to the public for inspection or copies thereof made; provided, however, that a request by the public shall be made through either the District, DLSE and the Apprenticeship Council. If the requested payroll records have not been provided, the requesting party shall, prior to being provided the records, reimburse the cost of preparation by the Contractor, Subcontractors and the entity through which the request was made; the public shall not be given access to such records at the principal office of the Contractor; (iv) the Contractor shall file a certified copy of the payroll records with the entity that requested such records within ten (10) days after receipt of a written request; (v) any copy of records made available for inspection as copies and furnished upon request to the public or any public agency by the District, the Apprenticeship Council or DLSE shall be marked or obliterated in such a manner as to prevent disclosure of an individual's name, address and social security number. The name and address of the Contractor or any Subcontractor, of any tier, performing a part of the Work shall not be marked or obliterated. The Contractor shall inform the District of the location of payroll records, including the street address, city and county and shall, within five (5) working days, provide a

notice of a change or location and address. In the event of noncompliance with the foregoing requirements, the Contractor shall have ten (10) days in which to comply, subsequent to receipt of written notice specifying in what respects the Contractor must comply herewith. Should noncompliance still be evident after such ten (10) day period, the Contractor shall, as a penalty to the District, forfeit One Hundred Dollars ($100.00) for each calendar day, or portion thereof, for each worker, until strict compliance is effectuated. Upon the request of the Apprenticeship Council or DLSE, such penalties shall be withheld from any portion of the Contract Price then or thereafter due the Contractor. The Contractor is solely responsible for compliance with the foregoing provisions.

4.19.3 Hours of Work**.**

4.19.3.1 Limits on Hours of Work. Pursuant to California Labor Code §1810, eight (8) hours of labor shall constitute a legal day's work. Pursuant to California Labor Code §1811, the time of service of any worker employed at any time by the Contractor or by a Subcontractor, of any tier, upon the Work or upon any part of the Work, is limited and restricted to eight (8) hours during any one calendar day and forty (40) hours during any one calendar week, except as hereafter provided. Notwithstanding the foregoing provisions, Work performed by employees of Contractor or any Subcontractor, of any tier, in excess of eight (8) hours per day and forty (40) hours during any one week, shall be permitted upon compensation for all hours worked in excess of eight (8) hours per day at not less than one and one-half (1½) times the basic rate of pay.

4.19.3.2 Penalty for Excess Hours. The Contractor shall pay to the District a penalty of Twenty-five Dollars ($25.00) for each worker employed on the Work by the Contractor or any Subcontractor, of any tier, for each calendar day during which such worker is required or permitted to work more than eight (8) hours in any calendar day and forty (40) hours in any one calendar week, in violation of the provisions of the California Labor Code, unless compensation to the worker so employed by the Contractor is not less than one and one-half (1½) times the basic rate of pay for all hours worked in excess of eight (8) hours per day.

4.19.3.3 Contractor Responsibility. Any Work performed by workers necessary to be performed after regular working hours or on Saturdays, Sundays or other holidays shall be performed without adjustment to the Contract Price or any other additional expense to the District. The Contractor shall be responsible for costs incurred by the District which arise out of Work performed by the Contractor at times other than regular working hours and regular working days. Upon determination of such costs, the District may deduct such costs from the Contract Price then or thereafter due the Contractor.

4.19.4 Apprentices**.**

4.19.4.1 Employment of Apprentices. Any apprentices employed to perform any of the Work shall be paid the standard wage paid to apprentices under the regulations of the craft or trade for which such apprentice is employed, and such individual shall be employed only for the work of the craft or trade to which such individual is registered. Only apprentices, as defined in California Labor Code §3077 who are in training under apprenticeship standards and written apprenticeship agreements under California Labor Code §§3070 et seq. are eligible to be employed for the Work. The employment and training of each apprentice shall be in accordance with the provisions of the apprenticeship standards and apprentice agreements under which such apprentice is training.

4.19.4.2 Apprenticeship Certificate. When the Contractor or any Subcontractor, of any tier, in performing any of the Work employs workers in any Apprenticeable Craft or Trade, the Contractor and such Subcontractor shall apply to the Joint

Apprenticeship Committee administering the apprenticeship standards of the craft or trade in the area of the site of the Work for a certificate approving the Contractor or such Subcontractor under the apprenticeship standards for the employment and training of apprentices in the area or industry affected, provided, however, that the approval as established by the Joint Apprenticeship Committee or Committees shall be subject to the approval of the Administrator of Apprenticeship. The Joint Apprenticeship Committee or Committees, subsequent to approving the Contractor or Subcontractor, shall arrange for the dispatch of apprentices to the Contractor or such Subcontractor in order to comply with California Labor Code §1777.5. Prior to the commencement of the Work, the Contractor and Subcontractors shall submit contract award information (on Form DAS-140) to the applicable Joint Apprenticeship Committee which shall include an estimate of journeyman hours to be performed under the Contract, the number of apprentices to be employed, and the approximate dates the apprentices will be employed. Concurrently with submission of contract information on Form DAS-140 to the Apprenticeship Council, the Contractor shall deliver a copy of its completed DAS-140 to the District and the Construction Manager. There shall be an affirmative duty upon the Joint Apprenticeship Committee or Committees, administering the apprenticeship standards of the crafts or trades in the area of the site of the Work, to ensure equal employment and affirmative action and apprenticeship for women and minorities. Contractors or Subcontractors shall not be required to submit individual applications for approval to local Joint Apprenticeship Committees provided they are already covered by the local apprenticeship standards.

4.19.4.3 Ratio of Apprentices to Journeymen. The ratio of Work performed by apprentices to journeymen, who shall be employed in the Work, may be the ratio stipulated in the apprenticeship standards under which the Joint Apprenticeship Committee operates, but in no case shall the ratio be less than one hour of apprentice work for each five hours of labor performed by a journeyman, except as otherwise provided in California Labor Code §1777.5. The minimum ratio for the land surveyor classification shall not be less than one apprentice for each five journeymen. Any ratio shall apply during any day or portion of a day when any journeyman, or the higher standard stipulated by the Joint Apprenticeship Committee, is employed at the site of the Work and shall be computed on the basis of the hours worked during the day by journeymen so employed, except for the land surveyor classification. The Contractor shall employ apprentices for the number of hours computed as above before the completion of the Work. The Contractor shall, however, endeavor, to the greatest extent possible, to employ apprentices during the same time period that the journeymen in the same craft or trade are employed at the site of the Work. Where an hourly apprenticeship ratio is not feasible for a particular craft or trade, the Division of Apprenticeship Standards, upon application of a Joint Apprenticeship Committee, may order a minimum ratio of not less than one apprentice for each five journeymen in a craft or trade classification. The Contractor or any Subcontractor covered by this Article and California Labor Code §1777.5, upon the issuance of the approval certificate, or if it has been previously approved in such craft or trade, shall employ the number of apprentices or the ratio of apprentices to journeymen stipulated in the apprenticeship standards. Upon proper showing by the Contractor that it employs apprentices in such craft or trade in the State of California on all of its contracts on an annual average of not less than one apprentice to each five journeymen, the Division of Apprenticeship Standards may grant a certificate exempting the Contractor from the 1-to-5 ratio as set forth

in this Article and California Labor Code §1777.5. This Article shall not apply to contracts of general contractors, or to contracts of specialty contractors not bidding for work through a general or prime contractor, involving less than Thirty Thousand Dollars ($30,000.00) or twenty (20) working days. The term "Apprenticeable Craft or Trade," as used herein shall mean a craft or trade determined as an Apprenticeable occupation in accordance with rules and regulations prescribed by the Apprenticeship Council.

4.19.4.4 Exemption From Ratios. The Joint Apprenticeship Committee shall have the discretion to grant a certificate, which shall be subject to the approval of the Administrator of Apprenticeship, exempting the Contractor from the 1-to-5 ratio set forth in this Article when it finds that any one of the following conditions are met: (i) unemployment for the previous three-month period in such area exceeds an average of fifteen percent (15%) or; (ii) the number of apprentices in training in such area exceeds a ratio of 1-to-5 in relation to journeymen, or; (iii) the Apprenticeable Craft or Trade is replacing at least one-thirtieth (1/30) of its journeymen annually through apprenticeship training, either on a statewide basis or on a local basis, or; (iv) if assignment of an apprentice to any Work performed under the Contract Documents would create a condition which would jeopardize such apprentice's life or the life, safety or property of fellow employees or the public at large, or if the specific task to which the apprentice is to be assigned is of such a nature that training cannot be provided by a journeyman. When such exemptions from the 1-to-5 ratio between apprentices and journeymen are granted to an organization which represents contractors in a specific trade on a local or statewide basis, the member contractors will not be required to submit individual applications for approval to local Joint Apprenticeship Committees, provided they are already covered by the local apprenticeship standards.

4.19.4.5 Contributions to Trust Funds. The Contractor or any Subcontractor, of any tier, who, performs any of the Work by employment of journeymen or apprentices in any Apprenticeable Craft or Trade and who is not contributing to a fund or funds to administer and conduct the apprenticeship program in any such craft or trade in the area of the site of the Work, to which fund or funds other contractors in the area of the site of the Work are contributing, shall contribute to the fund or funds in each craft or trade in which it employs journeymen or apprentices in the same amount or upon the same basis and in the same manner as the other contractors do, but where the trust fund administrators are unable to accept such funds, contractors not signatory to the trust agreement shall, using California Apprenticeship Council Training Fund Contributions Form CAC-2, pay a like amount to the California Apprenticeship Council. The Division of Labor Standards Enforcement is authorized to enforce the payment of such contributions to such fund(s) as set forth in California Labor Code §227. Such contributions shall not result in an increase in the Contract Price.

4.19.4.6 Contractor's Compliance. The responsibility of compliance with this Article for all Apprenticeable Trades or Crafts is solely and exclusively that of the Contractor. All decisions of the Joint Apprenticeship Committee(s) under this Article are subject to the provisions of California Labor Code §3081. If the Contractor willfully fails to comply with the provisions of this Article and California Labor Code §1777.5, pursuant to California Labor Code §1777.7, the Contractor shall: (i) be denied the right to bid on any public works contract for a period of one (1) year from the date the determination of non-compliance is made by the Administrator of Apprenticeship; and (ii) forfeit, as a civil penalty, Fifty Dollars ($50.00) for each calendar day of noncompliance. Notwithstanding the provisions of California Labor Code §1727, upon receipt of such determination,

the District shall withhold such amount from the Contract Price then due or to become due. Any such determination shall be issued after a full investigation, a fair and impartial hearing, and reasonable notice thereof in accordance with reasonable rules and procedures prescribed by the California Apprenticeship Council. Any funds withheld by the District pursuant to this Article shall be deposited in the General Fund or other similar fund of the District. The interpretation and enforcement of California Labor Code §§1777.5 and 1777.7 shall be in accordance with the rules and procedures of the California Apprenticeship Council.

4.19.5 Employment of Independent Contractors. Pursuant to California Labor Code §1021.5, Contractor shall not willingly and knowingly enter into any agreement with any person, as an independent contractor, to provide any services in connection with the Work where the services provided or to be provided requires that such person hold a valid contractors' license issued pursuant to California Business and Professions Code §§7000 et seq. and such person does not meet the burden of proof of his/her independent contractor status pursuant to California Labor Code §2750.5. If the Contractor employs any person in violation of the foregoing, Contractor shall be subject to the civil penalties under California Labor Code §1021.5 and any other penalty provided by law. In addition to the penalties provided under California Labor Code §1021.5, Contractor's violation of this Article 4.18.5 or the provisions of California Labor Code §1021.5 shall be deemed an event of Contractor's default under Article 15.1 of these General Conditions. The Contractor shall require any Subcontractor or Sub-Subcontractor performing or providing any portion of the Work to adhere to and comply with the foregoing provisions.

4.20 Assignment of Antitrust Claims. Pursuant to California Government Code §4551, the Contractor and its Subcontractor(s), of any tier, hereby offers and agrees to assign to the District all rights, title and interest in and to all causes of action they may have under Section 4 of the Clayton Act, (15 U.S.C. §15) or under the Cartwright Act (California Business and Professions Code §§16700 et seq.), arising from purchases of goods, services or materials hereunder or any Subcontract. This assignment shall be made and become effective at the time the District tenders Final Payment to the Contractor, without further acknowledgment by the parties. If the District receives, either through judgment or settlement, a monetary recovery in connection with a cause of action assigned under California Government Code §§4550 et seq., the assignor thereof shall be entitled to receive reimbursement for actual legal costs incurred and may, upon demand, recover from the District any portion of the recovery, including treble damages, attributable to overcharges that were paid by the assignor but were not paid by the District as part of the Contract Price, less the expenses incurred by the District in obtaining that portion of the recovery. Upon demand in writing by the assignor, the District shall, within one year from such demand, reassign the cause of action assigned pursuant to this Article if the assignor has been or may have been injured by the violation of law for which the cause of action arose: and (i) the District has not been injured thereby; or (ii) the District declines to file a court action for the cause of action.

4.21 DSA Construction Oversight. All of the Work is subject to DSA Construction Oversight processes and procedures; a material obligation of the Contractor hereunder is the Contractor's compliance with the processes and procedures established by DSA for the Work. As applicable, the foregoing shall include without limitation, the processes and procedures established under DSA PR 13-01 in effect at the time of performing the Work hereunder. The foregoing shall include:

4.21.1 DSA Approved Documents. The Contractor shall carefully study the DSA approved documents and shall plan a schedule of operations well ahead of time.

4.21.2 Correction of Non-Conforming Work. If at any time it is discovered that Work is not in accordance with the DSA approved construction documents, the Contractor shall correct the Work immediately.

4.21.3 Verification of DSA 152 Forms. The Contractor shall verify that DSA 152 forms were issued for prior to the commencement of construction.

4.21.4 Test/Inspection Communications. The Contractor shall meet with the Architect, Construction Manager, the Laboratory of Record retained by the District for special tests/inspections and the Project Inspector to mutually communicate and understand the testing and inspection program, and the methods of communication appropriate for the Work.

4.21.5 DSA Form 156 Notifications to Project Inspector. The Contractor shall notify the Project Inspector, in writing, of the commencement of construction of each and every aspect of the Work at least 48 hours in advance by submitting Commencement/Completion of Work Notification (form DSA 156), or other agreed upon written documents, to the Project Inspector. The Contractor shall notify the Project Inspector of the completion of construction of each and every aspect of the Work by submitting form DSA 156 (or other agreed upon written documents) to the Project Inspector.

4.21.6 Limitations on Contractor Work. Until the Project Inspector has signed off applicable blocks and sections of the form DSA 152, the Contractor may be prohibited from proceeding with subsequent construction activities that cover up the unapproved Work. Any subsequent construction activities, that cover up the unapproved Work, will be subject to a "Stop Work Order" from DSA or the District, and are subject to removal and remediation if found to be in non-compliance with the DSA approved construction documents.

4.21.7 Final Verified Report. The Contractor shall submit the final Contractor Verified Report. (form DSA 6-C) to DSA and the Project Inspector. The DSA 6-C reports are required to be submitted by the Contractor upon occurrence of any of the following events: (i) the Work is substantially complete (DSA considers the Work to be complete when the construction is sufficiently complete in accordance with the DSA approved construction documents so that the owner can occupy or utilize the Work); (ii) Work is suspended for a period of more than one (1) month; (iii) services of the Contractor are terminated for any reason prior to the completion of the Work; or (iv) DSA requests a verified report.

ARTICLE 5: SUBCONTRACTORS

5.1 Subcontracts. Any Work performed for the Contractor by a Subcontractor shall be pursuant to a written agreement between the Contractor and such Subcontractor which specifically incorporates by reference the Contract Documents and which specifically binds the Subcontractor to the applicable terms and conditions of the Contract Documents, including without limitation, the policies of insurance required under Article 6 of these General Conditions and obligates the Subcontractor to assume toward the Contractor all the obligations and responsibilities of the Contractor which by the Contract Documents the Contractor assumes toward the District and the Architect. The foregoing notwithstanding, no contractual relationship shall exist, or be deemed to exist, between any Subcontractor and the District, unless the Contract is terminated and District, in writing, elects to assume the Subcontract. Each Subcontract for a portion of the Work shall provide that such Subcontract may be assigned to the District if the Contract is terminated by the District pursuant to Article 15 hereof, subject to the prior rights of the Surety if the District terminates the Contract for the Contractor's default. The Contractor shall provide to the District copies of all executed Subcontracts and Purchase Orders to which Contractor is a party within thirty (30) days after Contractor's execution of the Agreement. During performance of the Work, the Contractor shall, from time to time, as and

when requested by the District, the Architect or the Construction Manager provide the District with copies of any and all Subcontracts or Purchase Orders relating to the Work and all modifications thereto. The Contractor's failure or refusal, for any reason, to provide copies of such Subcontracts or Purchase Orders in accordance with the two preceding sentences is Contractor's default of a material term of the Contract Documents.

5.2 Subcontractor DIR Contractor Registration.

5.2.1 No Subcontractor Performance of Work Without DIR Registration. No portion of the Work is permitted to be performed by a Subcontractor unless the Subcontractor is a DIR Registered contractor. The foregoing DIR contractor registration requirement is applicable for all Subcontractors, including without limitation, lower tier Subcontractors and Subcontractors who are not identified in the Contractor's Subcontractors List.

5.2.2 Contractor Obligation to Verify Subcontractor DIR Registration Status. An affirmative and on-going obligation of the Contractor under the Contract Documents is the Contractor's verification that all Subcontractors are at all times during performance of the Work in full and strict compliance with DIR contractor registration requirements. The Contractor shall not permit or allow any Subcontractor to perform any Work without the Contractor's verification that the Subcontractor is in full and strict compliance with DIR contractor registration requirements.

5.2.3 Contractor Obligation to Request Substitution of Listed Subcontractor Who Is Not DIR Registered Contractor. If Contractor inadvertently identified a Subcontractor in the Contractor's Subcontractors List submitted with the Contractor's proposal for the Work who was not a DIR registered contractor at the time of opening of proposals for the Work or if a Subcontractor's DIR contractor registration lapses prior to or during a Subcontractor's performance of Work, the Contractor shall request the District's consent to substitute the Subcontractor who is not a DIR registered contractor pursuant to Labor Code §1771.1(c)(3) and/or Labor Code §1771.1(d).

5.2.4 Contractor/Subcontractor Penalties pursuant to Labor Code § 1771.1(g). "If the Labor Commissioner or his or her designee determines that a contractor or subcontractor engaged in the performance of any public work contract without having been registered in accordance with this section, the contractor or subcontractor shall forfeit, as a civil penalty to the state, one hundred dollars ($100) for each day of work performed in violation of the registration requirement, not to exceed an aggregate penalty of eight thousand dollars ($8,000) in addition to any penalty registration fee assessed pursuant to clause (ii) of subparagraph (E) of paragraph (2) of subdivision (a) of Section 1725.5."

5.2.5 Subcontractor Penalties pursuant to Labor Code § 1771.1 (h)(1). "In addition to, or in lieu of, any other penalty or sanction authorized pursuant to this chapter, a higher tiered public works contractor or subcontractor who is found to have entered into a subcontract with an unregistered lower tier subcontractor to perform any public work in violation of the requirements of Section 1725.5 or this section shall be subject to forfeiture, as a civil penalty to the state, of one hundred dollars ($100) for each day the unregistered lower tier subcontractor performs work in violation of the registration requirement, not to exceed an aggregate penalty of ten thousand dollars ($10,000)."

5.3 Substitution of Listed Subcontractor.

5.3.1 Substitution Process. Request of the Contractor to substitute a listed Subcontractor will be considered only if in strict conformity with this Article 5.3 and California Public Contract Code §4107. All costs incurred by the District, including without limitation, costs of the Project Inspector, the Architect, the Construction Manager or attorney's fees in the review and evaluation of a request to substitute a listed Subcontractor shall be borne by the Contractor; such costs may be deducted by the District from the Contract Price then or thereafter due the Contractor.

5.3.2 Responsibilities of Contractor Upon Substitution of Subcontractor. The District's consent to Contractor's substitution of a listed Subcontractor shall not relieve Contractor from its obligation to complete the Work within the Contract Time and for the Contract Price. The substitution of a listed Subcontractor shall not, under any circumstance, result in, or give rise to any to any increase of the Contract Price or the Contract Time on account of such substitution. If the District consents to substitution of a listed Subcontractor, the Architect shall determine the extent to which, if any, revised or additional Submittals will be required of the newly substituted Subcontractor ("Substituted Subcontractor"). If the Architect determines that revised or additional Submittals are required of a Substituted Subcontractor, the Architect shall promptly notify the Contractor, in writing, of such requirement. In such event, revised or additional Submittals shall be submitted to Architect not later than thirty (30) days following the date of the Architect's written notice to the Contractor pursuant to the foregoing sentence; provided that if in the reasonable and good faith judgment of the Architect, the progress of the Work or completion of the Work requires submission of additional or revised Submittals by a Substituted Subcontractor in less than thirty (30) days, the Architect shall so state in its written notice to the Contractor. If the revised or additional Submittals are not submitted by Contractor within thirty (30) days, or such earlier time as determined by the Architect pursuant to the preceding sentence, following the Architect's written notice of the requirement for revised or additional Submittals, Contractor shall be subject to the per diem assessments for late Submittals as set forth in Article 4.7.2.1 of these General Conditions. Any revised or additional Submittals required pursuant to this Article 5.3.2 shall conform to the requirements of Article 4.7 of these General Conditions. Contractor shall reimburse the District for all fees and costs, including without limitation fees of the Architect, the District's administrative costs and DSA fees, incurred or associated with the processing, review and evaluation of any revised or additional Submittals required pursuant to this Article 5.3.2; the District may deduct such fees and costs from any portion of the Contract Price then or thereafter due the Contractor. In the event that additional or revised Submittals are required pursuant to this Article 5.3.2, such requirement shall not result in an increase to the Contract Time or the Contract Price.

5.4 Subcontractors' Work. Whenever the Work of a Subcontractor is dependent upon the Work of the Contractor or another Subcontractor, the Contractor shall require the Subcontractor to: (i) coordinate its Work with the dependent Work; (ii) provide necessary dependent data and requirements; (iii) supply and/or install items to build into the dependent Work of others; (iv) make appropriate provisions for dependent Work of others; (v) carefully examine and understand the portions of the Contract Documents (including Drawings, Specifications and Field Clarifications) and Submittals relating to the dependent Work; and (vi) examine the existing dependent Work and verify that the dependent Work is in proper condition for the Subcontractor's Work. If the dependent Work is not in a proper condition, the Subcontractor shall notify the Contractor in writing and not proceed with the Subcontractor's Work until the dependent Work has been corrected or replaced and is in a proper condition for the Subcontractor's Work.

ARTICLE 6: INSURANCE; INDEMNITY; BONDS

6.1 Owner Controlled Insurance Program. The District has elected, at its sole discretion, to implement an Owner Controlled Insurance Program ("OCIP") under the Statewide Educational Wrap Up Program ("SEWUP"). The SEWUP Joint Powers Authority ("JPA") will be providing the OCIP on behalf of the District. The requirements for enrollment in the OCIP, OCIP forms, OCIP coverages and other OCIP requirements are set forth in the OCIP Program description

incorporated as Attachment D to the Special Conditions.

6.2 Contractor OCIP Obligations.

6.2.1 Compliance With OCIP Requirements. Contractor agrees to comply with any and all terms and conditions of the policies of insurance provided by the District and to comply with any and all claims handling procedures, loss prevention programs and other programs required by or related to the District's OCIP as set forth herein. Contractor shall require Subcontractors and Sub-Subcontractor and all others covered by the District's OCIP insurance policies to so comply.

6.2.2 Contractor Furnishing of Information. Contractor, its Subcontractor and Sub-Subcontractors shall furnish to the District, the Architect, the OCIP Administrator, its designees or the insurers under the OCIP policies, all information and documentation that such entity may require from time to time in connection with the issuance of policies under this Contract or the administration of the OCIP in such form and substance as such entity may prescribe and promptly comply with the recommendations of the OCIP insurers.

6.2.3 No Violation of OCIP Insurance Policy Conditions. Contractor shall not violate, or knowingly permit to be violated; any conditions of the policies of insurance provided by the District hereunder and shall at all times satisfy the requirements of the insurers issuing them. Contractor shall assure that all OCIP requirements imposed upon, assumed and performed by each Subcontractor and Sub-Subcontractor.

6.3 District Rights. If the Contractor, Subcontractors, Sub-Subcontractors, or Excluded Parties should fail to comply with the Non-OCIP Insurance requirements, the District may withhold payment due to the Contractor or suspend the Work at the Contractors' sole expense and without adjustment of the Contract Price or Contract Time until such time as the Contractor, its Subcontractor, Sub-Subcontractors, and/or Excluded Parties have performed such obligations to the reasonable satisfaction of the District.

6.4 Withholding of Progress Payments/Final Payment. In addition to the rights of the District to withhold all or portions of Progress Payments or the Final Payment set forth elsewhere in the Contract Documents, the District may withhold Progress Payments or the Final Payment for the failure or refusal of the Contractor to comply with OCIP requirements, including without limitation, the reporting requirements set forth in the OCIP Program description or the OCIP insurance policies. Amounts withheld by the District pursuant to the preceding will be released only after the Contractor and/or Subcontractors' compliance with OCIP requirements, less costs and expenses incurred by the District in securing such compliance.

6.5 Evidence of Insurance; Subcontractor's Insurance.

6.5.1 Certificates of Insurance. Prior to commencing the Work, Contractor shall deliver to the District Certificates of Insurance evidencing the insurance coverages required by the Contract Documents. Failure or refusal of the Contractor to so deliver Certificates of Insurance may be deemed by the District to be a default of a material obligation of the Contractor under the Contract Documents, and thereupon the District may proceed to exercise any right or remedy provided for under the Contract Documents or at law. The Certificates of Insurance and the insurance policies required by the Contract Documents shall contain a provision that coverages afforded under such policies will not be canceled or allowed to expire until at least thirty (30) days prior written notice has been given to the District. The insurance policies required of Contractor hereunder shall also name

the District as an additional insured as its interests may appear. The additional Insured acknowledgement shall be submitted as a separate declaration from the Contractor's insurance provider (ACCORD form modifications are not acceptable). Should any policy of insurance be canceled before Final Acceptance of the Work by the District and the Contractor fails to immediately procure replacement insurance as required, the District reserves the right to procure such insurance and to deduct the premium cost thereof and other costs incurred by the District in connection therewith from any sum then or thereafter due the Contractor under the Contract Documents. The Contractor shall, from time to time, furnish the District, when requested, with satisfactory proof of coverage of each type of insurance required by the Contract Documents; failure of the Contractor to comply with the District's request may be deemed by the District to be a default of a material obligation of the Contractor under the Contract Documents.

6.5.2 Subcontractors' Insurance. Contractor shall require that every Subcontractor, to obtain and maintain the policies of insurance set forth in Articles 6.1 and 6.2 of these General Conditions; the coverages and limits of liability of such policies of insurance to be obtained and maintained by Subcontractors shall be as set forth in the Special Conditions. The policies of insurance to be obtained and maintained by Subcontractors hereunder are in addition to, and not in lieu of, Contractor obtaining and maintaining such policies of insurance. Each of the policies of insurance obtained and maintained by a Subcontractor hereunder shall conform to the requirements of this Article 6. Upon request of the District, Contractor shall promptly deliver to the District Certificates of Insurance evidencing that the Subcontractors have obtained and maintained policies of insurance in conformity with the requirements of this Article 6. Failure or refusal of the Contractor to provide the District with Subcontractors' Certificates of Insurance evidencing the insurance coverages required hereunder is a material default of Contractor hereunder.

6.6 Maintenance of Insurance. Any insurance bearing on the adequacy of performance of Work shall be maintained after the District's Final Acceptance of all of the Work for the full one year correction of Work period and any longer specific guarantee or warranty periods set forth in the Contract Documents. Should such insurance be canceled before the end of any such periods and the Contractor fails to immediately procure replacement insurance as specified, the District reserves the right to procure such insurance and to charge the cost thereof to the Contractor. Nothing contained in these insurance requirements is to be construed as limiting the extent of the Contractor's responsibility for payment of damages resulting from its operations or performance of the Work under the Contract Documents, including without limitation the Contractor's obligation to pay Liquidated Damages. In no instance will the District's exercise of its option to occupy and use completed portions of the Work relieve the Contractor of its obligation to maintain insurance required under this Article until the date of Final Acceptance of the Work by the District, or such time thereafter as required by the Contract Documents. The insurer providing any insurance coverage required hereunder shall be to the reasonable satisfaction of the District.

6.7 Contractor's Insurance Primary. All insurance and the coverages thereunder required to be obtained and maintained by Contractor hereunder, if overlapping with any policy of insurance maintained by the District, shall be deemed to be primary and non-contributing with any policy maintained by the District and any policy or coverage thereunder maintained by District shall be deemed excess insurance. To the extent that the District maintains a policy of insurance covering property damage arising out of the perils of fire or other casualty covered by the Contractor's Builder's Risk Insurance or the Comprehensive General Liability Insurance of the Contractor or any Subcontractor, the District, Contractor and all Subcontractors waive rights of subrogation against the others. The costs for obtaining and maintaining the insurance

coverages required herein shall be included in the Contract Price.

6.8 Indemnity. Unless arising solely out of the active negligence, gross negligence or willful misconduct the District or the Architect, the Contractor shall indemnify, defend and hold harmless the Indemnified Parties who are: (i) the District and its Board of Trustees, officers, employees, agents and representatives (including the District's Inspector); (ii) the Architect its respective agents and employees; and (iii) if one is designated by the District for the Work, the Construction Manager and its agents and employees; (iv) the OCIP Administrator. The Contractor's obligations hereunder includes indemnity, defense and hold harmless of the Indemnified Parties from and against any and all damages, losses, claims, demands or liabilities whether for damages, losses or other relief, including, without limitation attorney's fees and costs which arise, in whole or in part, from the Work, the Contract Documents or the negligent, grossly negligent or willful acts, omissions or other conduct of the Contractor, any Subcontractor or any person or entity engaged by them for the Work. The Contractor's obligations under the foregoing include without limitation: (i) injuries to or death of persons; (ii) damage to property; or (iii) theft or loss of property; (iv) Stop Notice claims asserted by any person or entity in connection with the Work; and (v) other losses, liabilities, damages or costs resulting from, in whole or part, any acts, omissions or other conduct of Contractor, any of Contractor's Subcontractors, of any tier, or any other person or entity employed directly or indirectly by Contractor in connection with the Work and their respective agents, officers or employees. If any action or proceeding, whether judicial, administrative, arbitration or otherwise, shall be commenced on account of any claim, demand or liability subject to Contractor's obligations hereunder, and such action or proceeding names any of the Indemnified Parties as a party thereto, the Contractor shall, at its sole cost and expense, defend the named Indemnified Parties in such action or proceeding with counsel reasonably satisfactory to the named Indemnified Parties. In the event that there shall be any judgment, award, ruling, settlement, or other relief arising out of any such action or proceeding to which any of the Indemnified Parties are bound by, Contractor shall pay, satisfy or otherwise discharge any such judgment, award, ruling, settlement or relief; Contractor shall indemnify and hold harmless the Indemnified Parties from any and all liability or responsibility arising out of any such judgment, award, ruling, settlement or relief. The Contractor's obligations hereunder are binding upon Contractor's Performance Bond Surety and these obligations shall survive notwithstanding Contractor's completion of the Work or the termination of the Contract.

6.9 Payment Bond; Performance Bond. Prior to commencement of the Work, the Contractor shall furnish a Performance Bond as security for Contractor's faithful performance of the Contract and a Labor and Material Payment Bond as security for payment of persons or entities performing work, labor or furnishing materials in connection with Contractor's performance of the Work under the Contract Documents. The penal sum of the Performance Bond and the Payment Bond shall each be one hundred percent (100%) of the Contract Price. Said Labor and Material Payment Bond and Performance Bond shall be in the form and content set forth in the Contract Documents. The failure or refusal of the Contractor to furnish either the Performance Bond or the Labor and Material Payment Bond in strict conformity with this Article 6.10 may be deemed by the District as a default by the Contractor of a material obligation hereunder. Upon request of the Contractor, the District may consider and accept, but is not obligated to do so, multiple sureties on such bonds. The Surety on any bond required under the Contract Documents shall be an Admitted Surety Insurer as that term is defined in California Code of Civil Procedure §995.120.

ARTICLE 7: CONTRACT TIME

7.1 Substantial Completion of the Work Within Contract Time. Unless otherwise expressly provided in the Contract Documents, the Contract Time is the period of time, including authorized adjustments thereto, allotted in the Contract Documents for achieving Substantial

Completion of the Work. The date for commencement of the Work is the date established by the Notice to Proceed issued by the District pursuant to the Agreement, which shall not be postponed by the failure to act of the Contractor or of persons or entities for whom the Contractor is responsible. The date of Substantial Completion is the date certified by the Architect and the Project Inspector as such in accordance with the Contract Documents.

7.2 Progress and Completion of the Work.

7.2.1 Time of Essence. Time limits stated in the Contract Documents are of the essence. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing and achieving Substantial Completion of the Work. The Contractor shall employ and supply a sufficient force of workers, material and equipment, and prosecute the Work with diligence so as to maintain progress, to prevent Work stoppage and to achieve Substantial Completion of the Work within the Contract Time.

7.2.2 Substantial Completion. Substantial Completion is that stage in the progress of the Work when the Work or any designated portion thereof (whether described as milestones, phases, segments or other similar terms) is complete in accordance with the Contract Documents so the District can occupy or use the Work or designated portion thereof for its intended purpose. Substantial Completion shall be determined by the Architect, Construction Manager, if any, and the Project Inspector upon request by the Contractor in accordance with the Contract Documents. The good faith and reasonable determination of Substantial Completion by the Project Inspector, Construction Manager, if any and the Architect shall be controlling and final.

7.2.3 Correction or Completion of the Work After Substantial Completion.

7.2.3.1 Punchlist. Upon achieving Substantial Completion of the Work, the District, the Project Inspector, the Construction Manager, if any, the Architect and the Contractor shall jointly inspect the Work and prepare a comprehensive list of items of the Work to be corrected or completed by the Contractor ("the Punchlist"). The exclusion of, or failure to include, any item on the Punchlist shall not alter or limit the obligation of the Contractor to complete or correct any portion of the Work in accordance with the Contract Documents.

7.2.3.2 Time for Completing Punchlist Items. In addition to establishing the Punchlist items pursuant to Article 7.2.3.1, the Construction Manager, if any, Contractor and Architect shall, after the joint inspection, establish a reasonable time for Contractor's completion of all Punchlist items. If mutual agreement is not reached to establish the time for the Contractor's completion of Punchlist items, the Architect shall determine such time, and in such event, the time determined by the Architect shall be final and binding upon the District and Contractor so long as the Architect's determination is made in good faith. The Contractor shall promptly and diligently proceed to complete all Punchlist items within the time established. If the Contractor fails or refuses, for any reason, to complete all Punchlist items within the time established, Contractor shall be subject to assessment of Liquidated Damages in accordance with Article 7.5 hereof. The foregoing notwithstanding, if the Contractor fails or refuses to complete all Punchlist items, the District may in its sole and exclusive discretion and without further notice to Contractor, elect to cause the completion of all remaining Punchlist items provided, however that such election by the District is in addition to and not in lieu of any other right or remedy of the District under the Contract Documents or at law. If the District elects to complete Punchlist items of the Work, pursuant to the foregoing, Contractor shall be responsible for all costs incurred by the District in connection herewith and the District may deduct such costs from the Contract Price then or thereafter due the Contractor, if these costs

exceed the remaining Contract Price due to the Contractor, the Contractor and the Performance Bond Surety are jointly and severally liable to District for any such excess costs.

7.2.4 Final Completion. Final Completion is that stage of the Work when all Work has been completed in accordance with the Contract Documents, including without limitation, all Punchlist items noted upon Substantial Completion, and the Contract has been otherwise fully performed by the Contractor. Final Completion shall be determined by the Architect, Construction Manager, if any and the Project Inspector upon request of the Contractor. The good faith and reasonable determination of Final Completion by the Project Inspector, Construction Manager, if any, and the Architect shall be controlling and final.

7.2.5 Contractor Responsibility for Multiple Inspections. If the Contractor requests determination of Substantial Completion or Final Completion by the Project Inspector, Construction Manager, if any, and the Architect and it is determined by the Project Inspector, Construction Manager, if any, or the Architect that the Work does not then justify certification of Substantial Completion or Final Completion and re-inspection is required at a subsequent time to make such determination, the Contractor shall be responsible for all costs of such re-inspection, including without limitation, the fees of the Architect, Construction Manager, if any, and the Project Inspector. The District may deduct such costs from the Contract Price then due or thereafter due to the Contractor.

7.2.6 Final Acceptance. Final Acceptance of the Work shall occur upon approval of the Work by the District's Board of Trustees; such approval shall be submitted for adoption at the next regularly scheduled meeting of the District's Board of Trustees after the determination of Final Completion. The commencement of any warranty or guarantee period under the Contract Documents is the date upon which the District's Board of Trustees approves of the Final Acceptance of the Work.

7.3 Construction Schedule.

7.3.1 Submittal of Preliminary Construction Schedule. Within five (5) days following execution of the Agreement, the Contractor shall prepare and submit to the District, the Construction Manager, if any, and the Architect a Preliminary Construction Schedule indicating, in graphic form, the estimated rate of progress and sequence of all Work required under the Contract Documents. The purpose of the Preliminary Construction Schedule is to assure adequate planning and execution of the Work so that it is completed within the Contract Time and to permit evaluation of the progress of the Work. Unless otherwise provided in the Special Conditions, the Construction Schedules required under this Article 7 shall; (i) be prepared with a commercially available computer software program in a critical path format; (ii) indicate the date(s) for commencement and completion of various portions of the Work including without limitation, procurement, fabrication and delivery of major items, materials or equipment; (iii) indicate manpower and other resources required for completion of each Construction Schedule activity; (iv) indicate costs for completion of each Construction Schedule activity; (v) identify each Submittal required by the Contract Documents, the date for the Contractor's submission of each Submittal and the date for the return of the reviewed Submittal to the Contractor. The Contractor may submit a Preliminary Construction Schedule depicting completion of the Work in a duration shorter than the Contract Time; provided that such Preliminary Construction Schedule shall not be a basis for adjustment to the Contract Price in the event that completion of the Work shall occur after the time depicted therein, nor shall such Preliminary Construction Schedule be the basis for any extension of the Contract Time, the Contractor's entitlement to any extension of the Contract Time shall be based upon the Contract Time and not on any shorter duration which may be depicted in the Contractor's Preliminary Construction Schedule. If the Construction Schedules required

under this Article 7.3 incorporate therein any "float" time, such float shall be deemed to jointly belong to and owned by the District and the Contractor. As used herein, "float time" shall be deemed to refer to the time between earliest finish date and the latest finish date of each activity shown on the Construction Schedule.

7.3.2 Review of Preliminary Construction Schedule. The District, the Construction Manager, if any, and the Architect shall review the Preliminary Construction Schedule submitted by the Contractor pursuant to Article 7.3.1 above for conformity with the requirements of the Contract Documents. Within fifteen (15) days of the date of receipt of the Preliminary Construction Schedule, the Preliminary Construction Schedule will be returned to the Contractor with comments to the form or content thereof. Review of the Preliminary Construction Schedule and any comments thereto by the District, the Construction Manager and/or the Architect shall not be deemed to be the assumption of construction means, methods or sequences by the District, the Construction Manager or the Architect, all of which remain the Contractor's obligations under the Contract Documents.

7.3.3 Preparation and Submittal of Contract Construction Schedule. Within ten (10) days of the District's return of the Preliminary Construction Schedule to the Contractor pursuant to Article 7.3.2 above, the Contractor shall prepare and submit to the Architect and the Construction Manager, if any, the Construction Schedule which incorporates therein the comments to the Preliminary Construction Schedule. Upon the Contractor's submittal of such Construction Schedule, the District, the Construction Manager and the Architect shall review the same for purposes of determining conformity with the requirements of the Contract Documents. Within fifteen (15) days of the receipt of the Construction Schedule, the District will approve such Construction Schedule or will return the same to the Contractor with comments to the form or content. In the event there are comments to the form or content thereof, the Contractor, shall within seven (7) days of receipt of such comments, revise and resubmit the Construction Schedule incorporating therein such comments. Upon the District's approval of the form and content of a Construction Schedule, the same shall be deemed the "Approved Construction Schedule." The District's approval of a Construction Schedule shall be for the sole and limited purpose of determining conformity with the requirements of the Contract Documents. By the Approved Construction Schedule, the District shall not be deemed to have exercised control over, or approval of, construction means, methods or sequences, all of which remain the responsibility and obligation of the Contractor in accordance with the terms of the Contract Documents. Further, the Approved Construction Schedule shall not operate to limit or restrict any of Contractor's obligations under the Contract Documents nor relieve the Contractor from the full, faithful and timely performance of such obligations in accordance with the terms of the Contract Documents. The activities, commencement and completion dates of activities, and the sequencing of activities depicted on the Approved Construction Schedule shall not be modified or revised by the Contractor without the prior consent, or direction, of the District and the Architect. Updates to the Approved Construction Schedule pursuant to Article 7.3.5 below shall not be deemed revisions to the Approved Construction Schedule. If the Approved Construction Schedule depicts completion of the Work in a duration shorter than the Contract Time, the same shall not be a basis for an adjustment of the Contract Time or the Contract Price in the event that actual completion of the Work shall occur after such the time depicted in such Approved Construction Schedule. In such event, the Contract Price shall not be subject to adjustment on account of any additional costs incurred by the Contractor to complete the Work prior to the Contract Time, as adjusted in accordance with the terms of the Contract Documents. Any adjustment of the Contract Time or the Contract Price shall be based upon the Contract Time set forth in the Contract Documents and not any shorter duration which may depicted in the Approved

Construction Schedule.

7.3.4 Revisions to Approved Construction Schedule. In the event that the progress of the Work or the sequencing of the activities of the Work shall materially differ from that indicated in the Approved Construction Schedule, as determined by the District in its reasonable discretion and judgment, the District may direct the Contractor to revise the Approved Construction Schedule; within fifteen (15) days of the District's direction, the Contractor shall prepare and submit to the Architect and the Construction Manager a revised Approved Construction Schedule, for review and approval by the District. The Contractor may request consent of the District to revise the Approved Construction Schedule. Any such request shall be considered by the District only if in writing setting forth the Contractor's proposed revision(s) to the Approved Construction Schedule and the reason(s) therefor. The District may consent to, or deny, any such request of the Contractor to revise the Approved Construction Schedule in its reasonable discretion.

7.3.5 Updates to Approved Construction Schedule. The Contractor shall monitor and update the Approved Construction Schedule on a monthly basis, or more frequently as required by the conditions or progress of the Work, or as may be requested by the District. The Contractor shall provide the District, the Construction Manager and the Architect with updated Approved Construction Schedules indicating progress achieved and activities commenced or completed within the prior updated Approved Construction Schedule. Updates to the Approved Construction Schedule shall not include any revisions to the activities, commencement and completion dates of activities or the sequencing of activities depicted on the Approved Construction Schedule. Any such revisions to the Approved Construction Schedule shall result in the District's rejection of such update and Contractor shall, within seven (7) days of the District's rejection of such update, submit to the Architect and the Construction Manager an Updated Approved Construction Schedule which does not incorporate any such revisions. If requested by the District, the Contractor shall also submit, with its updates to the Approved Construction Schedule a narrative statement including a description of current and anticipated problem areas of the Work, delaying factors and their impact, and an explanation of corrective action taken or proposed by the Contractor. If the progress of the Work is behind the Approved Construction Schedule, the Contractor shall indicate what measures will be taken to place the Work back on schedule. The District may, from time to time, and in the District's sole and exclusive discretion, transmit to the Contractor's Performance Bond Surety the Approved Construction Schedule, any updates thereof and the narrative statement described hereinabove. The District's election to transmit, or not to transmit such information, to the Contractor's Performance Bond Surety shall not limit the Contractor's obligations under the Contract Documents.

7.3.6 Contractor Responsibility for Construction Schedule. The Contractor shall be responsible for the preparation, submittal and maintenance of the Construction Schedules required by the Contract Documents, and any failure of the Contractor to do so may be deemed by the District as the Contractor's default in the performance of a material obligation under Contract Documents. Any and all costs or expenses required or incurred to prepare, submit, maintain, and update the Construction Schedules shall be solely that of the Contractor and no such cost or expense shall be charged to the District. The Contract Price shall not be subject to adjustment on account of costs, fees or expenses incurred or associated with the Contractor's preparation, submittal, maintenance or updating of the Construction Schedules.

7.4 Adjustment of Contract Time. If Substantial Completion is delayed, adjustment, if any, to the Contract Time on account of such delay shall be in accordance with this Article 7.4.

7.4.1 Excusable Delays. If Substantial Completion of the Work is delayed by Excusable Delays, the Contract Time shall be subject to adjustment for such reasonable

period of time as determined by the Architect; Excusable Delays shall not result in any increase in the Contract Price. Excusable Delays refer to unforeseeable and unavoidable casualties or other unforeseen causes beyond the control, and without fault or neglect, of the Contractor, any Subcontractor, Material Supplier or other person directly or indirectly engaged by the Contractor in performance of any portion of the Work. Excusable Delays include unanticipated and unavoidable labor disputes, unusual and unanticipated delays in transportation of equipment, materials or Construction Equipment reasonably necessary for completion and proper execution of the Work, unanticipated unusually severe weather conditions or DSA directive to stop the Work. Neither the financial resources of the Contractor or any person or entity directly or indirectly engaged by the Contractor in performance of any portion of the Work shall be deemed conditions beyond the control of the Contractor. If an event of Excusable Delay occurs, the Contract Time shall be subject to adjustment hereunder only if the Contractor establishes: (i) full compliance with all applicable provisions of the Contract Documents relative to the method, manner and time for Contractor's notice and request for adjustment of the Contract Time; (ii) that the event(s) forming the basis for Contractor's request to adjust the Contract Time are outside the reasonable control and without any fault or neglect of the Contractor or any person or entity directly or indirectly engaged by Contractor in performance of any portion of the Work; and (iii) that the event(s) forming the basis for Contractor's request to adjust the Contract Time directly and adversely impacted the progress of the Work as indicated in the Approved Construction Schedule or the most recent updated Approved Construction Schedule relative to the date(s) of the claimed event(s) of Excusable Delay. The foregoing provisions notwithstanding, if the Special Conditions set forth a number of "Rain Days" to be anticipated during performance of the Work, the Contract Time shall not be adjusted for rain related unusually severe weather conditions until and unless the actual number of Rain Days during performance of the Work exceeds those noted in the Special Conditions and such additional Rain Days directly and adversely impact the critical path progress of the Work as depicted in the Approved Construction Schedule or the most recent updated Approved Construction Schedule relative to the date(s) of such additional Rain Days.

7.4.2 Compensable Delays. If Substantial Completion of the Work is delayed and such delay is caused by the acts or omissions of the District, the Architect, or separate contractor employed by the District (collectively "Compensable Delays"), upon Contractor's request and notice, in strict conformity with Articles 7 and 9 of these General Conditions, the Contract Time will be adjusted by Change Order for such reasonable period of time as determined by the Architect and the District. In accordance with California Public Contract Code §7102, if the Contractor's progress is delayed by any of the events described in the preceding sentence, Contractor shall not be precluded from the recovery of damages directly and proximately resulting therefrom, provided that the District is liable for the delay, the delay is unreasonable under the circumstances involved and the delay was not within the reasonable contemplation of the District and the Contractor at the time of execution of the Agreement. In such event, Contractor's damages, if any, shall be limited to direct, actual and unavoidable additional costs of labor, materials or Construction Equipment directly resulting from such delay, and shall exclude indirect or other consequential damages, including without limitation, home office expenses, bond capacity impairment or loss of prospective economic advantage. Except as expressly provided for herein, Contractor shall not have any other claim, demand or right to adjustment of the Contract Price arising out of delay, interruption, hindrance or disruption to the progress of the Work. Adjustments to the Contract Price and the Contract Time, if any, on account of Changes to the Work or Suspension of the Work shall be governed by the applicable provisions of the Contract Documents, including without limitation, Articles 9 and 14 of these General Conditions.

7.4.3 Un-excusable Delays. Un-excusable Delays refer to any delay to the progress of the Work caused by events or factors other than those specifically identified in Articles 7.4.1 and 7.4.2 above. Neither the Contract Price nor the Contract Time shall be adjusted on account of Un-excusable Delays.

7.4.4 Procedure for Adjustment of Contract Time. The Contract Time shall be subject to adjustment only in strict conformity with applicable provisions of the Contract Documents. Failure of Contractor to request adjustment(s) of the Contract Time in strict conformity with applicable provisions of the Contract Documents shall be deemed Contractor's waiver of the same.

7.4.5 Limitations Upon Adjustment of Contract Time on Account of Delays. Any adjustment of the Contract Time on account of an Excusable Delay or a Compensable Delay shall be limited as set forth herein. If an Excusable Delay and a Compensable Delay occur concurrently, the maximum extension of the Contract Time shall be the number of days from the commencement of the first delay to the cessation of the delay which ends last. If an Un-excusable Delay occurs concurrently with either an Excusable Delay or a Compensable Delay, the maximum extension of the Contract Time shall be the number of days, if any, which the Excusable Delay or the Compensable Delay exceeds the period of time of the Un-excusable Delay. In addition to the foregoing limitations upon extension of the Contract Time, no adjustment of the Contract Time shall be made on account of any Excusable Delays or Compensable Delays unless such delay(s) actually and directly impact Work or Work activities on the critical path of the then current and updated Approved Construction Schedule as of the date on which such delay first occurs. The District shall not be deemed in breach of, or otherwise in default of any obligation hereunder, if the District shall deny any request by the Contractor for an adjustment of the Contract Time for any delay which does not actually and directly impact Work or Work activities on the critical path of the then current and updated Approved Construction Schedule.

7.5 Liquidated Damages. Should the Contractor neglect, fail or refuse to: (i) submit Submittals in accordance with the Approved Construction Schedule; (ii) achieve Substantial Completion of the Work or designated portions thereof within the Contract Time, (subject to adjustments authorized under the Contract Documents); (iii) or to complete Punchlist items within the time established pursuant to the Contract Documents, the Contractor agrees to pay to the District the amount of per diem Liquidated Damages set forth in the Special Conditions, not as a penalty but as Liquidated Damages, for every day beyond the Contract Time, as adjusted, until Submittals are submitted, Substantial Completion or completion of the Punchlist items are achieved. The Liquidated Damages amounts set forth in the Special Conditions are agreed upon by and between the Contractor and the District because of the difficulty of fixing the District's actual damages in the event of delayed submission of Submittals, Substantial Completion or completion of Punchlist items. The Contractor and the District specifically agree that said amounts are reasonable estimates of the District's damages in such event, and that such amounts do not constitute a penalty. Liquidated Damages may be deducted from the Contract Price then or thereafter due the Contractor. The Contractor and the Surety shall be liable to the District for any Liquidated Damages exceeding any amount of the Contract Price then held or retained by the District. In the event that the Contractor shall fail or refuse to complete Punchlist items and the District elects to exercise its right to cause completion or correction of such items pursuant to Article 7.2.3.2 hereof, the District's assessment of Liquidated Damages pursuant to the foregoing shall be in addition, and not in lieu of, the District's right to charge Contractor with the cost of completing or correcting such items of the Work, as provided for under Article 7.2.3.2. The Contractor and the District acknowledge and agree that the provisions of this Article 7.5 are reasonable under the circumstances existing at the time of the Contractor's execution of the Agreement.

7.6 District Right to Take-Over Work.

7.6.1 Progress of Work. Unless caused by the District, Architect, Construction Manager or the Project Inspector, if the Contractor fails or refuses, for any reason and at any time, to furnish adequate materials, labor, equipment or services to maintain progress of the Work in accordance with the then current Construction Schedule after seventy-two (72) hour advance written notice from the Construction Manager to the Contractor of its failure or refusal, the District may, without terminating the Contract or waiving, limiting or conditioning any right or remedy of the District, thereafter furnish or cause to be furnished such materials, labor, equipment or services necessary to maintain progress of the Work in accordance with the then current Construction Schedule. All costs, expenses or other charges (whether direct, indirect and administrative) incurred by the District in furnishing such materials, labor, equipment or services shall be at the sole cost of the Contractor and the District may deduct the same from the Contract Price then or thereafter due the Contractor. The District's exercise of rights pursuant to the foregoing shall not be deemed a waiver or limitation of any other right or remedy of the District under the Contract Documents.

7.6.2 Non-exclusive Remedy. The District's exercise of rights pursuant to the foregoing shall not be deemed a waiver or limitation of any other right or remedy of the District under the Contract Documents or the Laws.

ARTICLE 8: CONTRACT PRICE

8.1 Contract Price. The Contract Price is the amount stated in the Agreement and subject to adjustments thereto in accordance with the Contract Documents, is the total amount payable by the District to the Contractor for completion of the Work and other obligations of the Contractor under the Contract Documents. The District's payment of the Contract Price to the Contractor shall be in accordance with the Contract Documents.

8.2 Cost Breakdown and Schedule of Values. Within fifteen (15) days of the execution of the Agreement by Contractor, Contractor shall furnish, in a form acceptable to the District, a detailed estimate and complete Cost Breakdown of the Contract Price in the form of a Schedule of Values. The Cost Breakdown is subject to the District's review and approval of the form and content thereof. If the District objects to any portion of the Cost Breakdown, within ten (10) days of the District's receipt of the Cost Breakdown, the District shall notify the Contractor, in writing of the District's objection(s) to the Cost Breakdown. Within five (5) days of the date of the District's written objection(s), Contractor shall submit a revised Cost Breakdown to the District for review and approval. The foregoing procedure for the preparation, review and approval of the Cost Breakdown shall continue until the District has approved of the entirety of the Cost Breakdown. Upon the District's approval of the Cost Breakdown, the Cost Breakdown shall not be thereafter modified or amended by the Contractor without the prior consent and approval of the District, which may be granted, conditioned or withheld in the sole discretion of the District. Notwithstanding any provision of the Contract Documents to the contrary, payment of the Contractor's overhead, supervision and general conditions costs and profit, as such items are reflected in the Cost Breakdown, shall be made by the District in equal installments with its disbursements of Progress Payments and the Final Payment with the amount of each such installment equal to the aggregate amount of such items as reflected in the Cost Breakdown divided by the number of months of the Contract Time.

8.3 Progress Payments.

8.3.1 Applications for Progress Payments. During the Contractor's performance of the Work, the Contractor shall submit monthly, on the first working day of each month, to the District, Project Inspector, Construction Manager, if any, and the Architect, Applications for Progress Payments ("Payment Applications"), on forms approved by the District,

setting forth an itemized estimate of Work completed in the preceding month for the purpose of the District's making of Progress Payments thereon. Values utilized in the Payment Applications shall be based upon the District approved Cost Breakdown pursuant to Article 8.2 above provided that such values are only for determining the basis of Progress Payments to Contractor, and shall not be considered as fixing a basis for adjustments, whether additive or deductive, to the Contract Price, or for determining the extent of Work actually completed.

8.3.2 Payment Application Review for Determination of Proper Payment Application. In accordance with Public Contract Code §20104.50, upon receipt of an Application for Progress Payment, the District shall cause the same to be reviewed by the Project Inspector, the Construction Manager, if one is designated by the District, and the Architect, as soon as is practicable after receipt of such Application for Progress Payment. Such review shall be for the purpose of determining that the Application for Progress Payment is a proper Progress Payment request. For purposes of this Article 8.3.2, an Application for Progress Payment shall be deemed "proper" only if it is submitted on the form approved by the District, with all of the requested information of such form of Application for Progress Payment completely and accurately provided by the Contractor and such completed Application for Progress Payment is accompanied by: (i) the form of Verification of Certified Payroll Records Submittal to Labor Commissioner, executed under penalty of perjury by the Contractor's Superintendent and/or the Contractor PM; which verifies that all Certified Payroll Records for the Contractor and all Subcontractors for the period of time covered by the Application for Progress Payment have been completed and submitted in strict conformity with Labor Code §1771.4; (ii) Certified Payrolls of the Contractor and all Subcontractors for laborers performing any portion of the Work for which the Progress Payment is requested; (iii) duly completed and executed forms of Conditional Waiver and Release of Rights Upon Progress Payment in accordance with California Civil Code §8132 of the Contractor, all Subcontractors of any tier, and Material Suppliers covering the Progress Payment requested; (iv) duly completed and executed forms of Unconditional Waiver and Release of Rights upon Progress Payment in accordance with California Civil Code §8134 of the Contractor, all Subcontractors of any tier, and Material Suppliers covering the Progress Payment received by the Contractor under the prior Application for Progress Payment; (v) if applicable, a current union statement reflecting that the Contractor and any Subcontractor of any tier, are current in the payment of any supplemental fringe benefits required pursuant to any collective bargaining agreement to which the Contractor or any such Subcontractor is a party to or is otherwise bound by; (vi) a certification by the Contractor that it has continuously maintained, or caused to maintained, the Record Drawings reflecting the actual as-built conditions of the Work performed be for which the Progress Payment is requested, it being understood that such certification is subject to verification by the District, Architect or the Construction Manager prior to disbursement of the Progress Payment; and (vii) an updated Construction Schedule, reflecting Work actually completed and in progress. In accordance with Public Contract Code §20104.50, an Application for Progress Payment determined by the District not to be a proper Application for Progress Payment shall be returned by the District to the Contractor as soon as is practicable after receipt of the same from the Contractor, but in no event not more than seven (7) days after the District's receipt thereof. The District's return of any Application for Progress Payment pursuant to the preceding sentence shall be accompanied by a written document setting forth the reason(s) why the Application for Progress Payment is not proper.

8.3.3 Verification of Work Completed. Upon receipt of a Payment Application, the Architect, Construction Manager, if any and the Project Inspector shall inspect and verify

the Work to determine whether it has been performed in accordance with requirements of the Contract Documents and to determine the portion of the Payment Application which is properly due to the Contractor under the terms of the Contract Documents.

8.3.4 District's Disbursement of Progress Payments.

8.3.4.1 Timely Disbursement of Progress Payments. Pursuant to Public Contract Code §20104.50, within thirty (30) days after the District's receipt of a proper Payment Application, there shall be paid, by District, to Contractor a sum equal to ninety-five percent (95%) of the value of the Work indicated in the Payment Application which is actually in place as of the date of the Payment Application, as verified by the Project Inspector, Construction Manager, if any, and the Architect and the pro rata portion of the Contractor's overhead, supervision and general conditions costs and profit for that month; provided, however, that the District's obligation to disburse any Progress Payment shall be subject to the District's receipt of all documents set forth in Article 8.3.2 above, each and all of which are conditions precedent to the District's obligation to disburse Progress Payments. If a Payment Application is determined not to be proper due to the failure or refusal of the Contractor to submit documents with the Payment Application, as required by Article 8.3.2, or incompleteness or inaccuracies in any such documents submitted or if it is reasonably determined that the Record Drawings have not been continuously maintained to reflect the actual as built conditions of the Work completed in the period for which the Progress Payment is requested, the thirty (30) day period hereunder for the District's timely disbursement of a Progress Payment is deemed to commence on the date that the District is actually in receipt of documents not submitted with the Payment Application, or corrections to documents with the Payment Application so as to render them complete and accurate, or the date upon which the Contractor accurately and fully completes preparation of the Record Drawings relating to the Work for which the Progress Payment is requested.

8.3.4.2 Untimely Disbursement of Progress Payments. Pursuant to Public Contract Code §20104.50, if the District fails to make a Progress Payment within thirty (30) days after receipt of an undisputed and proper Payment Application, the District shall pay the Contractor interest on the undisputed amount of such Payment Application at the legal rate of interest set forth in California Code of Civil Procedure §685.010(a). The foregoing notwithstanding, if the District determines that any Payment Application is not proper, pursuant to Article 8.3.2 above, and the District does not return such Payment Application within the seven (7) day period provided for in Article 8.3.2, the period of time for the District's disbursement of the Progress Payment on such Payment Application without incurring interest liability shall be reduced by the number of days exceeding the seven (7) day return period.

8.3.4.3 District's Right to Disburse Payments by Joint Checks. The District, may, in its sole discretion, issue joint checks to the Contractor and Subcontractors/Material Suppliers in satisfaction of its obligation to make Progress Payments or the Final Payment due hereunder.

8.3.4.4 No Waiver of Defective or Non-Conforming Work. The approval of any Payment Application or the disbursement of any Progress Payment to the Contractor shall not be deemed nor constitute acceptance of defective or non-conforming Work.

8.3.5 Progress Payments for Changed Work. The Contractor's Payment Applications may include requests for payment on account of Changes in the Work which have been properly authorized and approved by the Project Inspector, the Architect and all other governmental agencies with jurisdiction over such Change in accordance with the terms

of the Contract Documents and for which a Change Order has been issued. Except as provided for herein, no other payment shall be made by the District for Changes in the Work.

8.3.6 Materials or Equipment Not Incorporated Into the Work.

8.3.6.1 Limitations Upon Payment. Except as expressly provided for herein, no payments shall be made by the District on account of any item of the Work, including without limitation, materials or equipment which, at the time of the Contractor's submittal of a Payment Application, has/have not been incorporated into and made a part of the Work.

8.3.6.2 Materials or Equipment Delivered and Stored at the Site. The District may, in its sole and exclusive discretion, make payment for materials or equipment not yet incorporated into the Work if, at or prior to the time of the Contractor's submittal of a Payment Application requesting payment for such materials or equipment if all of the following are complied with: (i) the materials or equipment have been delivered to the Site; (ii) adequate arrangements, reasonably satisfactory to the District, have been made by the Contractor to store and protect such materials or equipment at the Site including without limitation, insurance reasonably satisfactory to the District, covering and protecting against the risk of loss, destruction, theft or other damage to such materials or equipment while in storage; and (iii) the establishment of procedures reasonably satisfactory to the District by which title to such materials or equipment will be vested in the District upon the District's payment therefor. The Contractor acknowledges that the discretion to make, or not to make, payment for materials or equipment delivered or stored at the Site pursuant to the preceding sentence shall be exercised exclusively by the District; the District's exercise of discretion not to make payment shall not be deemed the District's default hereunder. If the District elects to make payment for materials or equipment delivered and stored at the Site, the costs and expenses incurred to comply with the requirements of (ii) and (iii) of this Article 8.3.6.2 shall be borne solely and exclusively by the Contractor and no payment shall be made by the District on account of such costs and expenses.

8.3.6.3 Materials or Equipment Not Delivered or Stored at the Site. No payments shall be made by the District for materials or equipment to be incorporated into the Work where such materials or equipment have not been delivered or stored at the Site or which are in the process of fabrication or transportation to the Site.

8.3.6.4 Materials or Equipment in Fabrication or Transit. The provisions of this Article 8.3.6.4 notwithstanding, the District shall not make any payment on account of any materials or equipment which are in the process of being fabricated or which are in transit to the Site of or other storage location.

8.3.7 Exclusions From Progress Payments. In addition to the District's right to withhold disbursement of any Progress Payment provided for in the Contract Documents, neither the Contractor's Payment Application shall include, nor shall the District be obligated to disburse any portion of the Contract Price for amounts which the Contractor does not intend to pay any Subcontractor or Material Supplier because of a dispute or any other reason.

8.3.8 Title to Work. The Contractor warrants that title to all Work covered by a Payment Application will pass to the District no later than the time of payment. The Contractor further warrants that upon submittal of a Payment Application, all Work for which a Progress Payment has been previously disbursed and the Contractor has received payment from the District therefor shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, stop notices, security interests

or encumbrances in favor of the Contractor, Subcontractors, Material Suppliers or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

8.3.9 Substitute Security for Retention. Pursuant to California Public Contract Code §22300, eligible and equivalent securities may be substituted for any monies withheld by the District to ensure the Contractor's performance under the Contract Documents at the request and expense of the Contractor and in conformity with the provisions of California Public Contract Code §22300. The foregoing and the provisions of California Public Contract Code §22300 notwithstanding, if the Contractor does not request the substitution of eligible and equivalent securities for monies to be withheld by the District on or before the date date of the submission of the first Application for Progress Payment, the Contractor is deemed to have waived the right to substitution of eligible and equivalent securities for monies to be withheld by the District pursuant to Public Contract Code §22300.

8.4 Final Payment.

8.4.1 Application for Final Payment. When the Contractor has achieved Final Completion of the Work and has otherwise fully performed its obligations under the Contract Documents, the Contractor shall submit an Application for Final Payment on such form as approved by the District. Thereupon, the Architect, Construction Manager, if any, and the Project Inspector will promptly make a final inspection of the Work and when the Architect, Construction Manager, if any and the Project Inspector find the Work acceptable under the Contract Documents and that the Contract has been fully performed by the Contractor, the Architect, Construction Manager, if any, and the Project Inspector will thereupon promptly approve the Application for Final Payment, stating that to the best their knowledge, information and belief, the Work has been completed in accordance with the terms of the Contract Documents. The Final Payment shall include the remaining balance of the Contract Price and any retention from Progress Payments previously withheld by the District.

8.4.2 Conditions Precedent to Disbursement of Final Payment. Neither Final Payment nor any remaining Contract Price shall become due until the Contractor submits to the District each and all of the following, the submittal of which are conditions precedent to the District's obligation to disburse the Final Payment: (i) an affidavit or certification by the Contractor that payrolls, bills for materials and other indebtedness incurred in connection with the Work for which the District or the District's property may or might be responsible or encumbered have been paid or otherwise satisfied; (ii) a certificate evidencing that insurance required by the Contract Documents to remain in force after the Contractor's receipt of Final Payment is currently in effect; (iii) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover any period following Final Payment as required by the Contract Documents; (iv) consent of the Surety on the Labor and Material Payment Bond and Performance Bond, to Final Payment if required; (v) duly completed and executed forms of Conditional or Unconditional Waivers and Releases of rights upon Final Payment of the Contractor, Subcontractors/Material Suppliers in accordance with California Civil Code §§8136 and 8138, with each of the same stating that there are, or will be, no claims for additional compensation after disbursement of the Final Payment; (vi) Operations and Maintenance manuals and separate warranties provided by any manufacturer or distributor of any materials or equipment incorporated into the Work; (vii) the Record Drawings; (viii) the form of Guarantee included in the Contract Documents duly executed by an authorized representative of the Contractor; (ix) any and all other items or documents required by the Contract Documents to be delivered to the District upon completion of the Work; (x) the completion and submittal of all reports required by the

Contract Documents, including without limitation, verified reports required by applicable provisions of the California Code of Regulations; and (xi) if required by the District, such other data establishing payment or satisfaction of obligations such as receipts, releases and waivers of liens, stop notices, claims, security interest or encumbrances arising out of the Contract to the extent and in such form as may be required by the District.

8.4.3 Disbursement of Final Payment. Provided that the District is then in receipt of all documents and other items in Article 8.4.2 above as conditions precedent to the District's obligation to disburse Final Payment, not later than sixty (60) days following Final Acceptance the District shall disburse the Final Payment to the Contractor. Pursuant to California Public Contract Code §7107, if there is any dispute between the District and the Contractor at the time that disbursement of the Final Payment is due, the District may withhold from disbursement of the Final Payment an amount not to exceed one hundred fifty percent (150%) of the amount in dispute. If the Contractor fails to timely submit completed DSA Reports in accordance with Article 4.21.1 above, the Final Payment due the Contractor shall be reduced in accordance with Article 4.21.2 above.

8.4.4 Waiver of Claims. The Contractor's acceptance of the Final Payment is a waiver and release by the Contractor of any and all claims against the District for compensation or otherwise in connection with the Contractor's performance of the Contract.

8.4.5 Claims Asserted After Final Payment. Any lien, stop notice or other claim filed or asserted after the Contractor's acceptance of the Final Payment by any Subcontractor, laborer, Material Supplier or others in connection with or for Work performed under the Contract Documents shall be the sole and exclusive responsibility of the Contractor and the Surety. The Contractor and Surety shall indemnify, defend and hold harmless the District and its officers, agents, representatives and employees from and against any claims, demands or judgments arising or associated therewith, including without limitation attorney's fees incurred by the District in connection therewith.

8.5 Withholding of Payments. The District may withhold any Progress Payment or the Final Payment, in whole or in part, or backcharge the Contractor to the extent it may deem advisable to protect the District on account of: (i) defective Work or Work not in conformity with the requirements of the Contract Documents which is not remedied; (ii) failure of the Contractor to make payments when due Subcontractors/Material Suppliers; (iii) claims filed or reasonable evidence of the probable filing of claims by Subcontractors, laborers, Material Suppliers, or others performing any portion of the Work under the Contract Documents for which the District may be liable or responsible including, without limitation, Stop Notice Claims filed with the District pursuant to California Civil Code §9350 et seq.; (iv) a reasonable doubt that the Contract can be completed for the then unpaid balance of the Contract Price; (v) tax demands filed in accordance with California Government Code §12419.4; (vi) other claims, penalties and/or forfeitures for which the District is required or authorized to retain funds otherwise due the Contractor; (vii) any amounts due from the Contractor to the District under the terms of the Contract Documents; or (viii) the Contractor's failure to perform any of its obligations under the Contract Documents, its default under the Contract Documents or its failure to maintain adequate progress of the Work. In addition to the foregoing, the District shall not be obligated to process any Payment Application or Application for Final Payment, nor shall Contractor be entitled to any Progress Payment or Final Payment so long as any lawful or proper direction concerning the Work or the performance thereof or any portion thereof, given by the District, the Project Inspector, the Architect or any public authority having jurisdiction over the Work, or any portion thereof, shall not be fully and completely complied with by the Contractor. When the District is reasonably satisfied that the Contractor has remedied any such deficiency, payment shall be made of the amount withheld.

8.6 Payments to Subcontractors. The Contractor shall pay all Subcontractors for and on

account of Work of the Contract performed by such Subcontractors in accordance with the terms of their respective subcontracts and as provided for pursuant to California Public Contract Code §10262, the provisions of which are deemed incorporated herein by this reference. If the Contractor fails to make payment to Subcontractors in conformity with California Public Contract Code §10262, the provisions of California Public Contract Code §10253 shall apply; by this reference, the provisions of California Public Contract Code §10253 are incorporated herein in its entirety, except that the references in said Section 10253 to "the director" shall be deemed to refer to the District. The Contractor shall timely make payment of retention due Subcontractors in accordance with Public Contract Code §7107.

8.7 Computerized Job Cost Reporting System.

8.7.1 Job Cost Reporting. The Contractor and each Subcontractor with a Subcontract valued at One Million Five Hundred Thousand Dollars ($1.5M) or greater shall maintain a computerized job cost reporting system conforming to the requirements set forth herein. The computer program(s) utilized by the Contractor and applicable Subcontractors shall be subject to the review and acceptance by the District. The job cost reporting systems for the Work shall be updated in regular intervals of not more than one (1) calendar month.

8.7.2 Job Cost Reporting System Requirements. The computerized job cost programs utilized by the Contractor and applicable Subcontractors shall conform and comply with generally accepted accounting principles applied in a consistent manner and with recognized and generally accepted construction industry accounting standards, guidelines and procedures. The job cost reporting system format and configuration shall follow the general format of the District approved Cost Breakdown and budgets established for each line item shall be traceable to a bid estimate of costs. The job cost reporting systems utilized by the Contractor and applicable Subcontractors shall be capable of: (i) providing overall cost status on a monthly and cumulative basis; (ii) providing comparative analysis of the original budgeted costs, actual costs, remaining budget, and projected cost of completion; the job cost reporting system shall be capable of providing comparative analysis for individual line items and the totality of the Work reflected in the job cost report and; (ii) tracking adjustments to original budget amounts for Changes to the Work (including, without limitation, issued, pending and potential Change Orders).

8.7.3 Job Cost System Information. Upon request of the District, the Contractor and applicable Subcontractors shall make available written job cost reports and/or provide the District with the electronic files of the then current or requested job cost report. The Contractor's obligations hereunder are material.

ARTICLE 9: CHANGES

9.1 Changes in the Work. The District, at any time, by written order, may make Changes within the general scope of the Work under the Contract Documents or issue additional instructions, require additional Work or direct deletion of Work. The Contractor shall not proceed with any Change involving an increase or decrease in the Contract Price or the Contract Time without prior written authorization from the District. The foregoing notwithstanding, the Contractor shall promptly commence and diligently complete any Change to the Work subject to the District's written authorization issued pursuant to the preceding sentence; the Contractor is not relieved or excused from its obligation to promptly commence and diligently complete any Change subject to the District's written authorization by virtue of the absence or inability of the Contractor and the District to agree upon the extent of any adjustment to the Contract Time or the Contract Price on account of such Change. The issuance of a Change Order pursuant to this Article 9 in connection with any Change authorized by the District under this Article 9.1 is not a condition precedent to Contractor's obligation to promptly commence and diligently

complete any such Change authorized by the District hereunder. The District's right to make Changes shall not invalidate the Contract nor relieve the Contractor of any liability or other obligations under the Contract Documents. Any requirement of notice of Changes in the scope of Work to the Surety shall be the responsibility of the Contractor. Changes to the Work depicted or described in the Drawings or the Specifications shall be subject to approval by the DSA. The District may make Changes to bring the Work or the Project into compliance with environmental requirements or standards established by Laws enacted after award of the Contract.

9.2 Construction Change Directive. A Construction Change Directive is a written instrument issued by or on behalf of the District directing a Change to the Work prior to the Contractor and District reaching full agreement on an adjustment of the Contract Time and/or Contract Price on account of such Change. The Contractor shall promptly commence and diligently complete any Change to the Work subject to a Construction Change Directive issued hereunder. The issuance of a Change Order pursuant to this Article 9 in connection with any Construction Change Directive authorized by the District is not a condition precedent to Contractor's obligation to promptly commence and diligently complete any such Construction Change Directive. Upon completion of the Work subject to a Construction Change Directive, if the Contractor and District have not agreed on the adjustment of Contract Time and/or Contract Price for such Change, District shall issue a Unilateral Change Order pursuant to this Article 9.

9.3 Oral Order of Change in the Work. Any oral order, direction, instruction, interpretation, or determination from the District or the Architect which in the opinion of the Contractor constitutes a Change to the Work, or otherwise requires an adjustment to the Contract Price or the Contract Time, shall be treated as a Change only if the Contractor gives the Architect, Construction Manager, if any and the Project Inspector written notice within ten (10) days of the order, directions, instructions, interpretation or determination and prior to acting in accordance therewith. Time is of the essence in Contractor's written notice pursuant to the preceding sentence. Accordingly, Contractor acknowledges that its failure, for any reason, to give written notice within ten (10) days of such order, direction, instruction, interpretation or determination is the Contractor's waiver of any right to assert or claim any entitlement to an adjustment of the Contract Time or the Contract Price on account of such order, direction, instruction, interpretation or determination. The written notice shall state the date, circumstances, extent of adjustment to the Contract Price or the Contract Time, if any, requested, and the source of the order, directions, instructions, interpretation or determination that the Contractor regards as a Change. Unless the Contractor acts in strict accordance with this procedure, any such order, direction, instruction, interpretation or determination shall not be treated as a Change and the Contractor waives any claim for any adjustment to the Contract Price or the Contract Time on account thereof.

9.4 Contractor Submittal of Data. Within thirty (30) days after receipt of a written order directing a Change in the Work or furnishing the written notice regarding any oral order directing a Change in the Work, the Contractor shall submit to the Architect, Construction Manager, if any, the Project Inspector and the District a detailed written statement setting forth the general nature of the Change, the adjustment to the Contract Price on account thereof, properly itemized and supported by sufficient substantiating data to permit evaluation of the same, and the extent of adjustment of the Contract Time, if any, required by such Change. No claim or adjustment to the Contract Price or the Contract Time shall be allowed if not asserted by the Contractor in strict conformity herewith or if asserted after Final Payment is made under the Contract Documents.

9.5 Adjustment to Contract Price and Contract Time on Account of Changes to the Work.

9.5.1 Adjustment to Contract Price. Adjustments to the Contract Price due to Changes

in the Work shall be determined by application of one of the following methods, in the following order of priority. Costs computed to any of the following methods shall exclude: (i) fees, salaries or other compensation for: field/office supervisory personnel, project engineers, scheduler, estimator, drafting/detailing; (ii) vehicles not directly engaged in performance of a Change; (iii) field/home office expenses, including personnel, materials, supplies, etc.; (iv) on-Site or off-Site trailer, storage costs (whether rented, leased or owned); and (v) except as incorporated into an applicable Prevailing Wage Rate for labor required to complete a Change, insurance (including without limitation, general liability, automobile liability, employer's liability and workers compensation)

9.5.1.1 Mutual Agreement. By negotiation and mutual agreement, on a lump sum basis, between the District and the Contractor on the basis of the estimate of the actual and direct increase or decrease in costs on account of the Change. Upon request of the District, Construction Manager, if any, or the Architect, the Contractor shall provide a detailed estimate of increase or decrease in costs directly associated with performance of the Change along with cost breakdowns of the components of the Change and supporting data and documentation. The Contractor's estimate of increase or decrease in costs pursuant to the foregoing, if requested, shall be in sufficient detail and in such form as to allow the District, the Project Inspector and the Architect to review and assess the completeness and accuracy thereof. The Contractor shall be solely responsible for any additional costs or additional time arising out of, or related in any manner to, its failure to provide the estimate of costs within the time specified in the request of the District or the Architect for such estimate.

9.5.1.2 Determination by the District. By the District, whether or not negotiations are initiated pursuant to Article 9.5.1.1 above, based upon actual and necessary costs incurred by the Contractor as determined by the District on the basis of the Contractor's records. In the event that the procedure set forth in this Article 9.5.1.2 is utilized to determine the extent of adjustment to the Contract Price on account of Changes to the Work, promptly upon determining the extent of adjustment to the Contract Price, the District shall notify the Contractor in writing of the same; the Contractor is deemed to have accepted the District's determination of the amount of adjustment to the Contract Price on account of a Change to the Work unless Contractor notifies the District, the Architect, Construction Manager, if any and the Project Inspector, in writing, not more than fifteen (15) days from the date of the District's written notice, of any objection to the District's determination. Failure of the Contractor to timely notify the District, the Construction Manager, the Architect and the Project Inspector of Contractor's objections to the District's determination of the extent of adjustment to the Contract Price shall be deemed Contractor's acceptance of the District's determination and a waiver of any right or basis of the Contractor to thereafter protest or otherwise object to the District's determination. Notwithstanding any objection of the Contractor to the District's determination of the extent of any adjustment to the Contract Price pursuant to this Article 9.5.1.2, Contractor shall, pursuant to Article 9.8 below, diligently proceed to perform and complete any such Change.

9.5.1.3 Basis for Adjustment of Contract Price. If Changes in the Work require an adjustment of the Contract Price pursuant to Articles 9.5.1.1 or 9.5.1.2 above, the basis for adjustment of the Contract Price shall be as follows:

9.5.1.3.1 Allowable Labor Costs. Except in the event adjustment of the Contract Price for a District authorized Change is computed by unit prices, the labor costs allowable for incorporation into a Contract Price adjustment for a Change shall be limited as set forth herein.

9.5.1.3.1.1 Limitation to Field Labor and Prevailing Wage Rates. The Contract Price adjustment for labor necessary to complete a Change shall be limited to the laborers of the Contractor or Subcontractors actually and necessarily engaged in the performance of the Change and for which there is a prevailing wage rate classification. Wage rates for laborers shall not exceed the applicable prevailing wage rate in the locality of the Site for the classification(s) of labor necessary to complete a Change. Use of a prevailing wage rate classification which increases the costs of a Change shall not be allowed. Overtime labor charges for performing any part of the Change shall only be allowed if authorized in writing by the Architect, Construction Manager and the District prior to Contractor's performance of the overtime labor. Use of a labor classification which would increase labor costs associated with any Change shall not be permitted.

9.5.1.3.1.2 Fringe Benefits, Payroll Taxes and Labor Burdens. The Contractor or Subcontractor may adjust the prevailing wage rate for allowable labor costs to reflect fringe benefits, payroll taxes and labor burdens actually incurred by Contractor and provided to such labor directly engaged in performing a Change. The allowable adjustment for fringe benefit payments, payroll taxes and labor burdens shall not, however, exceed fifteen percent (15%) of the applicable prevailing wage rate and shall not be subject to the additional mark-up set forth in Article 9.5.1.3.4 and the Special Conditions.

9.5.1.3.1.3 Excluded Labor Costs. The Contract Price adjustment for labor costs on account of a Change shall exclude costs: (i) for preparing estimate(s) of the costs of the Change; (ii) to maintain records relating to the costs of the Change; (iii) for coordination and assembly of materials and information relating to the Change or performance thereof; (iv) to supervise, coordinate or manage the Work of a Change; or (v) any other general administrative overhead or general conditions costs associated with the Change or performance thereof as such costs are incorporated into the overhead and general conditions mark-up costs set forth in Article 9.5.1.3.4.

9.5.1.3.2 Materials and Equipment. Contractor shall be compensated for the costs of materials and equipment necessarily and actually used or consumed in connection with the performance of Changes. Costs of materials and equipment may include reasonable costs of transportation from a source closest to the site of the Work and delivery to the Site. If discounts by Material Suppliers are available for materials necessarily used in the performance of Changes, they shall be credited to the District. If materials and/or equipment necessarily used in the performance of Changes are obtained from a supplier or source owned in whole or in part by the Contractor, compensation therefor shall not exceed the current wholesale price for such materials or equipment. If, in the reasonable opinion of the District, the costs asserted by the Contractor for materials and/or equipment in connection with any Change is excessive, or if the Contractor fails to provide satisfactory evidence of the actual costs of such materials and/or equipment from its supplier or vendor of the same, the costs of such materials and/or equipment and the District's obligation

for payment of the same shall be limited to the then lowest wholesale price at which similar materials and/or equipment are available in the quantities required to perform the Change. The District may elect to furnish materials and/or equipment for Changes to the Work, in which event the Contractor shall not be compensated for the costs of furnishing such materials and/or equipment or any mark-up thereon.

9.5.1.3.3 Construction Equipment. Contractor shall be compensated for the actual cost of the necessary and direct use of Construction Equipment in the performance of Changes to the Work. Use of such Construction Equipment in the performance of Changes to the Work shall be compensated in increments of fifteen (15) minutes. Rental time for Construction Equipment moved by its own power shall include time required to move such Construction Equipment to the site of the Work from the nearest available rental source of the same. If Construction Equipment is not moved to the Site by its own power, Contractor will be compensated for the loading and transportation costs in lieu of rental time. The foregoing notwithstanding, neither moving time or loading and transportation time shall be allowed if the Construction Equipment is used for performance of any portion of the Work other than Changes to the Work. Unless prior approval in writing is obtained by the Contractor from the Architect, Construction Manager, if any, the Project Inspector and the District, no costs or compensation shall be allowed for time while Construction Equipment is inoperative, idle or on standby, for any reason. The Contractor shall not be entitled to an allowance or any other compensation for Construction Equipment or tools used in the performance of Changes to the Work where such Construction Equipment or tools have a replacement value of $500.00 or less. Construction Equipment costs claimed by the Contractor in connection with the performance of any Change to the Work shall not exceed rental rates established by distributors or construction equipment rental agencies in the locality of the Site; any costs asserted which exceed such rental rates shall not be allowed or paid. Unless otherwise specifically approved in writing by the Architect, Construction Manager, if any, the Project Inspector and the District, the allowable rate for the use of Construction Equipment in connection with Changes to the Work shall constitute full compensation to the Contractor for the cost of rental, fuel, power, oil, lubrication, supplies, necessary attachments, repairs or maintenance of any kind, depreciation, storage, insurance, labor (exclusive of labor costs of the Construction Equipment operator), and any all other costs incurred by the Contractor incidental to the use of such Construction Equipment.

9.5.1.3.4 Mark-up on Costs of Changes to the Work. In determining the cost to the District and the extent of increase to the Contract Price resulting from a Change adding to the Work, the allowance for mark-ups on the costs of the Change for all overhead (including home office and field overhead), general conditions costs and profit associated with the Change shall not exceed the percentage set forth in the Special Conditions, regardless of the number of Subcontractors, of any tier, performing any portion of any Change to the Work. If a Change to the Work reduces the Contract Price, no profit, general conditions or overhead costs shall be paid by the District to the Contractor for the reduced or deleted Work. In such event, the adjustment to the Contract

Price shall be the actual cost reduction realized by the reduced or deleted Work multiplied by the percentage set forth in the Special Conditions for mark-ups on the cost of a Change adding to the scope of the Work.

9.5.1.4 Contractor Maintenance of Records. If the Contractor is directed to perform any Changes to the Work pursuant to Article 9.1, 9.2 or 9.3, or should the Contractor encounter conditions which the Contractor believes to obligate the District to adjust the Contract Price and/or the Contract Time, Contractor shall maintain detailed records on a daily basis. Such records shall include without limitation hourly records for labor and Construction Equipment and itemized records of materials and equipment used that day in connection with the performance of any Change to the Work. If more than one Change to the Work is performed by the Contractor in a calendar day, Contractor shall maintain separate records of labor, Construction Equipment, materials and equipment for each such Change. If any Subcontractor provides or performs any portion of a Change to the Work, Contractor shall require that each such Subcontractor maintain records in accordance with this Article. Each daily record maintained hereunder shall be signed by Contractor's Superintendent or Contractor's authorized representative which shall constitute the Contractor's representation and warranty to the District that all information contained therein is true, accurate, complete and relate only to the Change referenced therein. All records maintained by a Subcontractor relating to the costs of a Change to the Work shall be signed by such Subcontractor's authorized representative or Superintendent. All records maintained hereunder shall be subject to inspection, review and/or reproduction by the District, the Architect, Construction Manager, if any or the Project Inspector upon request. If the Contractor fails or refuses, for any reason, to maintain or make available for inspection, review and/or reproduction such records and the adjustment to the Contract Price on account of any Change to the Work, the District's reasonable good faith determination of the extent of adjustment to the Contract Price on account of such Change shall be final, conclusive, dispositive and binding upon Contractor. Contractor's obligation to maintain records hereunder is in addition to, and not in lieu of, any other Contractor obligation under the Contract Documents with respect to Changes to the Work.

9.5.2 Adjustment to Contract Time. If any Change to the Work authorized pursuant to this Article 9, the Contract Time affects the critical path of the Work, the Contract Time shall be extended or reduced by Change Order for a period of time commensurate with the time reasonably necessary to perform such Change. The Contractor is solely responsible for submitting scheduling data, analysis and other materials necessary or required by the District to substantiate the Contract Time adjustment requested by the Contractor for a Change. The District is not obligated to consider any adjustment to the Contract Time on account of a Change until the Contractor has submitted such scheduling data, analysis and other materials.

9.5.3 Addition or Deletion of Alternate Bid Item(s). If the Bid Proposal for the Work includes proposal(s) for Alternate Bid Item(s), during Contractor's performance of the Work, the District may elect, pursuant to this Article to add any such Alternate Bid Item(s) if the same did not form a basis for award of the Contract or delete any such Alternate Bid Item(s) if the same formed a basis for award of the Contract. If the District elects to add or delete any such Alternate Bid Item(s) pursuant to the foregoing, the cost or credit for such Alternate Bid Item(s) shall be as set forth in the Contractor's Bid. If any Alternate Bid Item is added or deleted from the Work pursuant to the foregoing, the Contract Time shall be adjusted by the number of days allocated for the added or deleted Alternate Bid Item in the Contract Documents; if days are not allocated for any Alternate Bid Item

added or deleted pursuant to the foregoing, the Contract Time shall be equitably adjusted.

9.6 Change Orders. If the District approves of a Change, a written Change Order prepared by the Architect on behalf of the District shall be forwarded to the Contractor describing the Change and setting forth the adjustment to the Contract Time and the Contract Price, if any, on account of such Change. All Change Orders shall be in full payment and final settlement of all claims for direct, indirect and consequential costs, costs of delays or impacts related to, or arising out of, items covered and affected by the Change Order, including without limitation: impacts of any kind; preparation and processing of any and all related RFIs, ASIs, Bulletins, FCDs, Quotes, and/or CCDs; inefficiencies; productivity losses; delay; acceleration; field and home office overhead; and any and all other incidental costs for all of the work described in the Change Order, as well as any and all adjustments to the Contract Time necessitated thereby. Any claim or item relating to any Change incorporated into a Change Order not presented by the Contractor for inclusion in the Change Order shall be deemed waived. The Contractor shall execute the Change Order prepared pursuant to the foregoing; once the Change Order has been prepared and forwarded to the Contractor for execution, without the prior approval of the District which may be granted or withheld in the sole and exclusive discretion of the District, the Contractor shall not modify or amend the form or content of such Change Order, or any portion thereof. The Contractor's attempted or purported modification or amendment of any such Change Order, without the prior approval of the District, shall not be binding upon the District; any such unapproved modification or amendment to such Change Order shall be null, void and unenforceable. Unless otherwise expressly provided for in the Contract Documents or in the Change Order, any Change Order issued hereunder shall be binding upon the District only upon action of the District's Board of Trustees approving and ratifying such Change Order. In the event of any amendment or modification made by the Contractor to a Change Order for which there is no prior approval by the District, in accordance with the provisions of this Article 9.6, unless otherwise expressly stated in its approval and ratification of such Change Order, any action of the Board of Trustees to approve and ratify such Change Order shall be deemed to be limited to the Change Order as prepared by the Architect; such approval and ratification of such Change Order shall not be deemed the District's approval and ratification of any unapproved amendment or modification by the Contractor to such Change Order.

9.7 Unilateral Change Orders. A Unilateral Change Order is a Change Order issued by the District, in the sole and exclusive discretion of the District, before the Contractor and District have agreed on the extent of adjustment of the Contract Time or the Contract Price relating to a Change. The District may, in its sole reasonable discretion, issue a Unilateral Change Order for any Change to the Work authorized by the District when the Contractor and the District have been unable to reach mutual agreement as to the extent of any adjustment to the Contract Price or Contract Time on account of such Change. If the District elects to issue a Unilateral Change Order, the District shall forward to the Contractor a copy of the proposed Unilateral Change Order (for the Contractor's information) at least ten (10) days prior to the date of the Board of Trustees' meeting to review and consider approval of the Unilateral Change Order. Any Unilateral Change Order issued hereunder shall be binding upon the District and Contractor only if the District's Board of Trustees' takes action to approve or ratify the Unilateral Change Order. Any and all claims by the Contractor arising out of such Unilateral Change Order, and/or the Change giving rise to such Unilateral Change Order, shall accrue as of the date of the Board of Trustees' action approving or ratifying a Unilateral Change Order and shall be subject to the claim provisions set forth in Article 16.11. Notwithstanding any provision of the Contract Documents to the contrary, an express condition precedent to the Contractor's exercise of rights and remedies under Article 16.11 relating to a Unilateral Change Order, is the Contractor notification to the District, Architect and Construction Manager, if any, in writing of the

Contractor's objections to all or any portion of a Unilateral Change Order within ten (10) days after the date of the Board of Trustees meeting ratifying or approving a Unilateral Change Order; failure of the Contractor to do so is deemed the Contractor's acceptance of the entirety of a Unilateral Change Order, as approved or ratified by the District's Board of Trustees and an express unequivocal waiver by the Contractor of any right or remedy of the Contractor, under the Contract Documents or the Laws to: (i) object to the Unilateral Change Order or any portion thereof; or (ii) further adjustment of the Contract Time or the Contract Price on account of the Change(s) incorporated into a Unilateral Change Order.

9.8 Contractor Notice of Changes. If the Contractor claims that any instruction, request, the Drawings, the Specifications, action, condition, omission, default, or other situation obligates the District to increase the Contract Price or to extend the Contract Time, the Contractor shall notify the Construction Manager, if any, the Project Inspector and the Architect, in writing, of such claim within ten (10) days from the date of its actual or constructive notice of the factual basis supporting the same. The District shall consider any such claim of the Contractor only if sufficient supporting documentation is submitted with the Contractor's notice to the Project Inspector and the Architect. Time is of the essence in Contractor's written notice pursuant to the preceding sentence so that the District can promptly investigate and consider alternative measures to the address such instruction, request, Drawings, Specifications, action, condition, omission, default or other situation. Accordingly, Contractor acknowledges that its failure, for any reason, to give written notice (with sufficient supporting documentation to permit the District's review and evaluation) within ten (10) days of its actual or constructive knowledge of any instruction, request, Drawings, Specifications, action, condition, omission, default or other situation for which the Contractor believes there should an adjustment of the Contract Time or the Contract Price shall be deemed Contractor's waiver, release, discharge and relinquishment of any right to assert or claim any entitlement to an adjustment of the Contract Time or the Contract Price on account of any such instruction, request, Drawings, Specifications, action, condition, omission, default or other situation. In the event that the District determines that the Contract Price or the Contract Time are subject to adjustment based upon the events, circumstances and supporting documentation submitted with the Contractor's written notice under this Article 9.8, any such adjustment shall be determined in accordance with the provisions of Articles 9.5.1 and 9.5.2.

9.9 Disputed Changes. If there is any dispute or disagreement between the Contractor and the District regarding the characterization of any item as a Change to the Work or as to the appropriate adjustment of the Contract Price or the Contract Time on account thereof, the Contractor shall promptly proceed with the performance and completion of such item of the Work, subject to a subsequent resolution of such dispute or disagreement in accordance with the terms of the Contract Documents. The Contractor's failure or refusal to so proceed with such Work is the Contractor's default of a material obligation of the Contractor under the Contract Documents.

9.10 Emergencies. In an emergency affecting or threatening the safety of persons, or which affects or threatens the Work, or property, the Contractor, without special instruction or prior authorization from the District, Construction Manager or the Architect, is permitted to act at its discretion to prevent such threatened loss or injury. Any compensation claimed by the Contractor on account of such emergency work shall be submitted and determined in accordance with this Article 9.

9.11 Minor Changes in the Work. The Architect may order minor Changes in the Work not involving an adjustment in the Contract Price or the Contract Time and not inconsistent with the intent of the Contract Documents. Such Changes shall be effected by written order and shall

be binding on the District and the Contractor. The Contractor shall carry out such orders promptly.

9.12 Unauthorized Changes. Any Work beyond the lines and grades shown on the Contract Documents, or any extra Work performed or provided by the Contractor without notice to the Architect, Construction Manager and the Project Inspector in the manner and within the time set forth in Articles 9.2 or 9.8 shall be considered unauthorized and at the sole expense of the Contractor. Work so done will not be measured or paid for, no extension to the Contract Time will be granted on account thereof and any such Work may be ordered removed at the Contractor's sole cost and expense. The failure of the District to direct or order removal of such Work shall not constitute acceptance or approval of such Work nor relieve the Contractor from any liability on account thereof.

ARTICLE 10: SEPARATE CONTRACTORS

10.1 District's Right to Award Separate Contracts. The District reserves the right to perform construction or operations related to the Project with the District's own forces or to award separate contracts in connection with other portions of the Project or other construction or operations at or about the Site. If the Contractor claims that delay or additional cost is involved because of such action by the District, the Contractor shall seek an adjustment to the Contract Price or the Contract Time as provided for in the Contract Documents. Failure of the Contractor to request such an adjustment of the Contract Time or the Contract Price in strict conformity with the provisions of the Contract Documents applicable thereto shall be deemed a waiver of the same.

10.2 District's Coordination of Separate Contractors. The District shall provide for coordination of the activities of the District's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the District in reviewing their respective Construction Schedules when directed to do so. The Contractor shall make any revisions to the Approved Construction Schedule for the Work hereunder deemed necessary after a joint review and mutual agreement. The Construction Schedules shall then constitute the Construction Schedules to be used by the Contractor, separate contractors and the District until subsequently revised.

10.3 Mutual Responsibility. The Contractor shall afford the District and separate contractors of the District reasonable opportunity for storage of their materials and equipment and performance of their activities at the Site and shall connect and coordinate the Contractor's Work, construction and operations with theirs as required by the Contract Documents.

10.4 Discrepancies or Defects. If part of the Contractor's Work depends for proper execution or results upon construction or operations by the District or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Architect, Construction Manager, if any and the Project Inspector any discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results of the Contractor's Work. Failure of the Contractor to so report shall constitute an acknowledgment that the District's or separate contractors' completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then discoverable by the Contractor's reasonable diligence.

ARTICLE 11: TESTS AND INSPECTIONS

11.1 Tests; Inspections; Observations.

11.1.1 Contractor's Notice. If the Contract Documents, the Laws or any public authority with jurisdiction over the Work requires the Work, or any portion thereof, to be specially

tested, inspected or approved, the Contractor shall give the Architect, the Construction Manager and the Project Inspector written notice of the readiness of such Work for observation, testing or inspection at least two (2) working days prior to the time for the conducting of such test, inspection or observation. The Contractor shall not cover up any portion of the Work subject to tests, inspections or observations prior to the completion and satisfaction of the requirements of such test, inspection or observation. If any portion of the Work subject to tests, inspection or approval is covered up by Contractor prior to completion and satisfaction of the requirements of such tests, inspection or approval, Contractor shall be responsible for the uncovering of such portion of the Work as is necessary for performing such tests, inspection or approval without adjustment of the Contract Price or the Contract Time on account thereof.

11.1.2 Cost of Tests and Inspections. The District will pay for fees, costs and expenses for the initial tests/inspections of materials/equipment which are conducted at the Site or locations within a one hundred (100) mile radius of the Site. All fees, costs or expenses for subsequent tests/inspections or for tests/inspections conducted at a location more than a one hundred (100) mile radius from the Site (including without limitation, travel and travel-related expenses) shall be borne solely and exclusively by the Contractor.

11.1.3 Testing/Inspection Laboratory. The District shall select duly qualified person(s) or testing laboratory(ies) to conduct the tests and inspections to be paid for by the District and required by the Contract Documents. All such tests and inspections shall be in conformity with the Laws, including without limitation, Title 24 of the California Code of Regulations. Where inspection or testing is to be conducted by an independent laboratory or testing agency, materials or samples thereof shall be selected by the laboratory, testing agency, the Project Inspector, the Construction Manager or the Architect and not by the Contractor.

11.1.4 Additional Tests, Inspections and Approvals. If the Architect, the Construction Manager, the Project Inspector or public authorities having jurisdiction over the Work determine that portions of the Work require additional testing, inspection or approval, the Architect or Construction Manager, if any will, upon written authorization from the District, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the District, and the Contractor shall give timely notice to the Architect, the Construction Manager and the Project Inspector of when and where tests and inspections are to be made so the Project Inspector and the Architect may observe such procedures. The District shall bear the costs of such additional tests, inspections or approvals, except to the extent that such additional tests, inspections or approvals reveal any failure of the Work to comply with the requirements of the Contract Documents, in which case the Contractor shall bear all costs made necessary by such failures, including without limitation, the costs of corrections, repeat tests, inspections or approvals and the fees of the Architect, Construction Manager, if any, and the Project Inspector in connection therewith.

11.2 Delivery of Certificates. Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

11.3 Timeliness of Tests, Inspections and Approvals. Tests or inspections required and conducted pursuant to the Contract Documents shall be made or arranged by Contractor to avoid delay in the progress of the Work.

ARTICLE 12: UNCOVERING AND CORRECTION OF WORK

12.1 Inspection of the Work.

12.1.1 Access to the Work. All Work and all materials and equipment forming a part of

the Work or incorporated into the Work are subject to inspection by the District, the Construction Manager, the Architect and the Project Inspector for conformity with the Contract Documents. The Contractor shall, at its cost and without adjustment to the Contract Price or the Contract Time, furnish any facilities necessary for sufficient and safe access to the Work for purposes of inspection by the District, the Construction Manager, the Architect, the Project Inspector, DSA or any other public or quasi-public authority with jurisdiction over the Work or any portion thereof.

12.1.2 Limitations Upon Inspections. Inspections, tests, measurements, or other acts of the Architect and the Project Inspector hereunder are for the sole purpose of assisting them in determining that the Work, materials, equipment, progress of the Work, and quantities generally comply and conform to the requirements of the Contract Documents. These acts or functions shall not relieve the Contractor from performing the Work in full compliance with the Contract Documents. No inspection by the Architect or the Project Inspector shall constitute or imply acceptance of Work inspected. Inspection of the Work hereunder is in addition to, and not in lieu of, any other testing, inspections or approvals of the Work required under the Contract Documents.

12.2 Uncovering of Work. If any portion of the Work is covered contrary to the request of the Architect, the Project Inspector or the requirements of the Contract Documents, it must, if required by the Architect or the Project Inspector, be uncovered for observation by the Architect and the Project Inspector and be replaced at the Contractor's expense without adjustment of the Contract Time or the Contract Price.

12.3 Rejection of Work. Prior to the District's Final Acceptance of the Work, any Work or materials or equipment forming a part of the Work or incorporated into the Work which constitutes Defective or Non-Conforming Work may be rejected by the District, the Construction Manager the Architect or the Project Inspector and the Contractor shall correct such rejected Work without any adjustment to the Contract Price or the Contract Time, even if the Work, materials or equipment have been previously inspected by the Architect or the Project Inspector or even if they failed to observe the Defective or Non-Conforming nature of the Work, materials or equipment.

12.4 Correction of Work. The Contractor shall promptly correct any Defective or Non-Conforming Work whether observed before or after Substantial Completion and whether or not fabricated, installed or completed. The Contractor shall bear all costs of correcting Defective or Non-Conforming Work, including additional testing and inspections and compensation for the Architect's services and expenses made necessary thereby. The Contractor shall bear all costs of correcting destroyed or damaged construction, whether completed or partially completed, of the District or separate contractors, caused by the Contractor's correction or removal of Defective or Non-Conforming Work.

12.5 Removal of Non-Conforming or Defective Work. The Contractor shall, at its sole cost and expense, remove from the Site all Defective or Non-Conforming Work which are neither corrected by the Contractor nor accepted by the District.

12.6 Failure of Contractor to Correct Work. If the Contractor fails to commence to correct Defective or Non-Conforming Work within three (3) days of notice of such condition and promptly thereafter complete the same within a reasonable time, the District may correct it in accordance with the Contract Documents. If the Contractor does not proceed with correction of such Defective or Non-Conforming Work within the time fixed herein, the District may remove it and store the salvageable materials or equipment at the Contractor's expense. If the Contractor does not pay costs of such removal and storage after written notice, the District may sell such

materials or equipment at auction or at private sale and shall account for the proceeds thereof, after deducting costs and damages that should have been borne by the Contractor, including without limitation compensation for the Architect's services, attorney's fees and other expenses made necessary thereby. If such proceeds of sale do not cover costs which the Contractor should have borne, the Contract Price shall be reduced by the deficiency. If payments of the Contract Price then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor and the Surety shall be jointly and severally liable to the District for any such excess amount.

12.7 Acceptance of Defective or Non-Conforming Work. The District may, in its sole and exclusive discretion, elect to accept Defective or Non-Conforming Work in lieu of requiring its removal and correction, in which case the Contract Price shall be reduced as appropriate and equitable. The District's determination of the extent of reduction of the Contract Price on account of Defective or Non-Conforming Work accepted by the District shall be binding, conclusive, dispositive and not subject to appeal or other dispute resolution procedures, unless such determination is manifestly unreasonable.

ARTICLE 13: WARRANTIES

13.1 Workmanship and Materials. The Contractor warrants to the District that: (i) the Work and all materials and equipment incorporated therein conform to requirements of the Contract Documents; (ii) all materials and equipment incorporated into the Work are new, of good quality and of the most suitable grade and quality for the purpose intended, unless otherwise specified in the Contract Documents; and (iii) all Work and workmanship is of good quality, free from faults and defects and in conformity with the requirements of the Contract Documents. If required by the Architect, Project Inspector, Construction Manager or the District, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment incorporated into the Work. Any Work or portion thereof not conforming to these requirements, including substitutions or alternatives not properly approved in accordance with the Contract Documents may be deemed Defective or Non-Conforming. Where there is an approved substitution of, or alternative to, material or equipment specified in the Contract Documents, the Contractor warrants to the District that such installation, construction, material, or equipment will equally perform the function and have the quality of the originally specified material or equipment. The Contractor expressly warrants the merchantability, the fitness for use, and quality of all substitute or alternative items in addition to any warranty given by the manufacturer or supplier of such item. The obligations of the Contractor hereunder are in addition to, and not in lieu of, any other obligations imposed by any special guarantee or warranty required by the Contract Documents, guarantees or warranties provided by any manufacturer of any item or equipment forming a part of, or incorporated into the Work, or otherwise recognized, prescribed or imposed by the Laws.

13.2 Warranty Work. If, within one (1) year after the date of Final Acceptance, or such other time frame set forth elsewhere in the Contract Documents, any of the Work is found to be defective or not in accordance with the requirements of the Contract Documents, or otherwise contrary to the warranties contained in the Contract Documents, the Contractor shall commence all necessary corrective action not more than three (3) days after receipt of a written notice from the District to do so, and to thereafter diligently complete the same. If the Contractor fails or refuses to commence correction of any such item within said three (3) day period or to diligently prosecute such corrective actions to completion, the District may, without further notice to Contractor, cause such corrective Work to be performed and completed. In such event, Contractor and Contractor's Performance Bond Surety shall be responsible for all costs in connection with such corrective Work, including without limitation, general administrative overhead costs of the District in securing and overseeing such corrective Work. Nothing contained herein shall be construed to establish a period of limitation with respect to any

obligation of the Contractor under the Contract Documents. Neither the District's Final Acceptance, the making of Final Payment, any provision in Contract Documents, nor the use or occupancy of the Work, in whole or in part, by District shall constitute acceptance of Work not in accordance with the Contract Documents nor relieve the Contractor or the Contractor's Performance Bond Surety from liability with respect to any warranties or responsibility for faulty or defective Work or materials, equipment and workmanship incorporated therein.

13.3 Guarantee. Upon completion of the Work, Contractor shall execute and deliver to the District the form of Guarantee (Attachment D to Special Conditions). The Contractor's execution and delivery of the form of Guarantee is an express condition precedent to any obligation of the District to disburse the Final Payment to the Contractor and any right of the Contractor to Final Payment.

13.4 Survival of Warranties; Surety Obligations. The Contractor's warranty obligations hereunder shall survive the Contractor's completion of Work under the Contract Documents, the District's Final Acceptance or the termination of the Contract. The obligations of the Surety issuing the Performance Bond shall include assumption and discharge of the Contractor's warranty obligations if the Contractor fails or refuses to perform its warranty obligations hereunder in strict conformity herewith.

ARTICLE 14: SUSPENSION OF WORK

14.1 District's Right to Suspend Work. The District may, without cause, and without invalidating or terminating the Contract, order the Contractor, in writing, to suspend, delay or interrupt the Work in whole or in part for such period of time as the District may determine. The Contractor shall resume and complete the Work suspended by the District in accordance with the District's directive, whether issued at the time of the directive suspending the Work or subsequent thereto.

14.2 Adjustments to Contract Price and Contract Time. In the event the District shall order suspension of the Work, an adjustment shall be made to the Contract Price for increases in the direct cost of performance of the Work of the Contract Documents, actually caused by suspension, delay or interruption ordered by the District; provided however that no adjustment of the Contract Price shall be made to the extent: (i) that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible under the Contract Documents; or (ii) that an equitable adjustment is made or denied under another provision of the Contract Documents. The foregoing notwithstanding, any such adjustment of the Contract Price shall not include any adjustment to increase the Contractor's overhead, general administrative costs or profit, all of which will remain as reflected in the Cost Breakdown submitted by the Contractor pursuant to the Contract Documents. In the event of the District's suspension of the Work, the Contract Time shall be equitably adjusted.

ARTICLE 15: TERMINATION

15.1 Termination for Cause.

15.1.1 District's Right to Terminate. The District may terminate the Contract upon the occurrence of any one or more of the following events of the Contractor's default: (i) if the Contractor refuses or fails to prosecute the Work with diligence as will insure Substantial Completion of the Work within the Contract Time, or if the Contractor fails to substantially Complete the Work within the Contract Time; (ii) if the Contractor becomes bankrupt or insolvent, or makes a general assignment for the benefit of creditors, or if the Contractor or a third party files a petition to reorganize or for protection under any bankruptcy or similar laws, or if a trustee or receiver is appointed for the Contractor or for any of the Contractor's property on account of the Contractor's insolvency, and the

Contractor or its successor in interest does not provide adequate assurance of future performance in accordance with the Contract Documents within ten (10) days of receipt of a request for such assurance from the District; (iii) if the Contractor repeatedly fails to supply sufficient skilled workmen or suitable materials or equipment; (iv) if the Contractor repeatedly fails to make prompt payments to any Subcontractor, of any tier, or Material Suppliers or others for labor, materials or equipment; (v) if the Contractor disregards the Laws or requirements of any public entity having jurisdiction over any portion of the Work; (iv) if the Contractor disregards proper directives of the Architect, the Construction Manager, the Project Inspector or District; (vii) Defective/Non-Conforming Work which the Contractor neglects or refuses to correct; or (viii) if the Contractor otherwise violates any provisions or requirements of the Contract Documents. Once the District determines that sufficient cause exists to justify the action, the District may terminate the Contract without prejudice to any other right or remedy the District may have, after giving the Contractor and the Surety at least seven (7) days advance written notice of the effective date of termination. The District shall have the sole discretion to permit the Contractor to remedy the cause for the termination without waiving the District's right to terminate the Contract, or otherwise waiving, restricting or limiting any other right or remedy of the District under the Contract Documents or the Laws.

15.1.2 District's Rights Upon Termination. If the Contract is terminated pursuant to this Article 15.1, the District may take over the Work and prosecute it to completion, by contract or otherwise, and may exclude the Contractor from the site. The District may take possession of the Work and of all of the Contractor's tools, appliances, construction equipment, machinery, materials, and plant which may be on or about the Site, and use the same to the full extent they could be used by the Contractor without liability to the Contractor. In exercising the District's right to prosecute the completion of the Work, the District may also take possession of all materials and equipment at or about the Site or for which the District has paid the Contractor but which are stored elsewhere, and finish the Work as the District deems expedient. In exercising the District's right to prosecute the completion of the Work, the District shall have the right to exercise its sole discretion as to the manner, methods, and reasonableness of the costs of completing the Work and the District shall not be required to obtain the lowest price for completion of the Work. If the District takes bids for remedial Work or completion of the Work, the Contractor shall not be eligible for the award of such contract(s).

15.1.3 Completion by the Surety. If the Contract is terminated pursuant to this Article 15.1, the District may demand that the Surety take over and complete the Work. The District may require that in so doing, the Surety not utilize the Contractor in performing and completing the Work. Upon the failure or refusal of the Surety to take over and begin completion of the Work within twenty (20) days after demand therefor, the District may take over the Work and prosecute it to completion as provided for above.

15.1.4 Assignment and Assumption of Subcontracts. The District shall, in its sole and exclusive discretion, have the option of requiring any Subcontractor or Material Supplier to perform in accordance with its Subcontract or Purchase Order with the Contractor and assign the Subcontract or Purchase Order to the District or such other person or entity selected by the District to complete the Work.

15.1.5 Costs of Completion. In the event of termination under this Article 15.1, the Contractor shall not be entitled to receive any further payment of the Contract Price until the Work is completed. If the unpaid balance of the Contract Price as of the date of termination exceeds the District's direct and indirect costs and expenses for completing the Work, including without limitation, attorneys' fees, fees for additional professional and consultant services, and the District's administrative costs, such excess shall be used to pay the Contractor for the cost of the Work performed prior to the effective date of termination with a reasonable allowance for overhead and profit. If the District's costs

and expenses to complete the Work exceed the unpaid Contract Price, the Contractor and Surety are jointly and severally liable for payment of such difference to the District.

15.1.6 Contractor Responsibility for Damages. The Contractor and the Surety shall be jointly and severally liable for all damage sustained by the District resulting from, in any manner, the termination of Contract under this Article 15.1, including without limitation, attorneys' fees, and for all costs necessary for repair and completion of the Work exceeding the Contract Price.

15.1.7 Conversion to Termination for Convenience. In the event the Contract is terminated under this Article 15.1, and it is determined, for any reason, that the Contractor was not in default under the provisions hereof, the termination shall be deemed a Termination for Convenience of the District and thereupon, the rights and obligations of the District and the Contractor shall be determined in accordance with Article 15.2 hereof.

15.1.8 District's Rights Cumulative. In the event the Contract is terminated pursuant to this Article 15.1, the termination shall not affect or limit any rights or remedies of the District against the Contractor or the Surety. The rights and remedies of the District under this Article 15.1 are in addition to, and not in lieu of, any other rights and remedies provided by the Laws or under the Contract Documents. Any retention or payment of monies to the Contractor by the District shall not be deemed to release the Contractor or the Surety from any liability hereunder.

15.2 Termination for Convenience of the District. The District may at any time, in its sole and exclusive discretion, by written notice to the Contractor, terminate the Contract in whole or in part when it is in the interest of, or for the convenience of, the District. In such case, the Contractor shall be entitled to payment for: (i) Work actually performed and in place as of the effective date of such termination for convenience of the District, with a reasonable allowance for profit and overhead on such Work, and (ii) reasonable termination expenses for reasonable protection of Work in place and suitable storage and protection of materials and equipment delivered to the site of the Work but not yet incorporated into the Work, provided that such payments exclusive of termination expenses shall not exceed the total Contract Price as reduced by payments previously made to the Contractor and as further reduced by the value of the Work as not yet completed. The Contractor shall not be entitled to profit and overhead on Work which was not performed as of the effective date of the termination for convenience of the District. The District may, in its sole discretion, elect to have Subcontracts assigned pursuant to Article 15.1.4 above after exercising the right hereunder to terminate for the District's convenience.

ARTICLE 16: MISCELLANEOUS

16.1 Governing Law. This Contract shall be governed by and interpreted in accordance with the laws of the State of California.

16.2 Marginal Headings; Interpretation. The titles of the various Articles of these General Conditions and elsewhere in the Contract Documents are used for convenience of reference only and are not intended to, and shall in no way, enlarge or diminish the rights or obligations of the District or the Contractor and shall have no effect upon the construction or interpretation of the Contract Documents. The Contract Documents shall be construed as a whole in accordance with their fair meaning and not strictly for or against the District or the Contractor.

16.3 Successors and Assigns. Except as otherwise expressly provided in the Contract Documents, all terms, conditions and covenants of the Contract Documents shall be binding upon, and shall inure to the benefit of the District and the Contractor and their respective heirs, representatives, successors-in-interest and assigns.

16.4 Cumulative Rights and Remedies; No Waiver. Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not in lieu of or otherwise a limitation or restriction of duties, obligations, rights and remedies otherwise imposed or available by law. No action or failure to act by the District shall constitute a waiver of a right or remedy afforded it under the Contract Documents or at law nor shall such an action or failure to act constitute approval of or acquiescence in a breach hereunder, except as may be specifically agreed in writing.

16.5 Severability. If any provision of the Contract Documents is deemed illegal, invalid, unenforceable and/or void, by a court or any other governmental agency of competent jurisdiction, such provision shall be deemed to be severed and deleted from the Contract Documents, but all remaining provisions hereof, shall in all other respects, continue in full force and effect.

16.6 No Assignment by Contractor. The Contractor shall not sublet or assign the Contract, or any portion thereof, or any monies due thereunder, without the express prior written consent and approval of the District, which approval may be withheld in the sole and exclusive discretion of the District. The District's approval to such assignment shall be upon such terms and conditions as determined by the District in its sole and exclusive discretion.

16.7 Gender and Number. Whenever the context of the Contract Documents so require, the neuter gender shall include the feminine and masculine, the masculine gender shall include the feminine and neuter, the singular number shall include the plural and the plural number shall include the singular.

16.8 Independent Contractor Status. In performing its obligations under the Contract Documents, the Contractor is an independent contractor to the District and not an agent or employee of the District.

16.9 Notices. Except as otherwise expressly provided for in the Contract Documents, all notices which the District or the Contractor may be required, or may desire, to serve on the other, shall be effective only if delivered by personal delivery or by postage prepaid, First Class Certified Return Receipt Requested United States Mail, addressed to the District or the Contractor at their respective address set forth in the Contract Documents, or such other address(es) as either the District or the Contractor may designate from time to time by written notice to the other in conformity with the provisions hereof. In the event of personal delivery, such notices shall be deemed effective upon delivery, provided that such personal delivery requires a signed receipt by the recipient acknowledging delivery of the same. In the event of mailed notices, such notice shall be deemed effective on the third working day after deposit in the mail.

16.10 Disputes; Continuation of Work. Notwithstanding any claim, dispute or other disagreement between the District and the Contractor regarding performance under the Contract Documents, the scope of Work thereunder, or any other matter arising out of or related to, in any manner, the Contract Documents, the Contractor shall proceed diligently with performance of the Work in accordance with the District's written direction, pending any final determination or decision regarding any such claim, dispute or disagreement.

16.11 Dispute/Claims Resolution.

16.11.1 Contractor Continuation of Work. Notwithstanding any claim, dispute, disagreement or other matter in controversy between the District and the

Contractor relating to the Contract Documents and/or the Work, the Contractor shall continue to diligently prosecute and perform the Work in accordance with requirements of the Contract Documents, pending any final determination or decision regarding any such claim, dispute, disagreement or matter in controversy.

16.11.2 Public Contract Code §9204 Claims Resolution Procedures. Claims of the Contractor are subject to the non-binding dispute resolution procedures set forth in Public Contract Code §9204 ("Section 9204") provided, however, that the Contractor's initiation of Section 9204 procedures is expressly subject to the Contractor's prior full and timely compliance with requirements and procedures of the Contract Documents relating to procedures for resolution of claims, change orders, disputes and other matters in controversy under the Contract Documents.

16.11.2.1 Claim Defined. The term "Claim" shall be as defined in Section 9204.

16.11.2.2 Claim Documentation. The Contractor shall furnish reasonable documentation to support each Claim. "Reasonable documentation" includes, without limitation: (i) contractual and legal basis establishing Claim entitlement or merit; (ii) factual basis establishing District liability for the Claim; (iii) detailed breakdown of labor, materials, equipment and other costs included in the Claim; and (iv) detailed basis, including Construction Schedule analysis and fragnets supporting any Contract Time adjustment or Liquidated Damages relief included in the scope of a Claim.

16.11.2.3 District Claim Review Statement. Within forty five (45) days (or such other time mutually agreed to by the District and the Contractor) after receipt of a properly submitted and properly documented Claim, the District will conduct a reasonable review of the Claim and provide the Contractor with a written statement identifying the disputed and undisputed portions of the Claim ("Claim Review Statement"). If the District does not provide the Contractor with the Claim Review Statement for any Claim within forty five (45) days (or other time mutually agreed to by the District and the Contractor) after receipt of a properly submitted and properly documented Claim, the Claim is deemed rejected in its entirety and thereupon, the Contractor may initiate the Meet and Confer process described below. A Claim deemed rejected pursuant to the foregoing does not constitute an adverse finding of Claim merit or the Contractor's responsibility or qualifications. If the Claim Review Statement identifies any undisputed portion of a Claim ("Undisputed Claim") and payment is due from the District on the Undisputed Claim, the District shall process and make payment on the Undisputed Claim within sixty (60) days after the issuance date of the Claim Review Statement.

16.11.2.4 Meet and Confer.

16.11.2.4.1 Meet and Confer Demand. If the Contractor disputes any portion of the Claim Review Statement, or if a Claim is deemed rejected by the District not providing the Contractor with the Claim Review Statement within the time permitted under Section 9204, the Contractor may demand an informal conference to meet and confer with the District for settlement of the issues in dispute

("Meet and Confer"). The Contractor's Meet and Confer request must be submitted to the District: (i) in writing; (ii) by registered mail or certified mail, return receipt requested; and (iii) within ten (10) days after the Claim Review Statement is submitted to the Contractor or within ten (10) days after the date the Claim is deemed rejected, as applicable. Failure of the Contractor to strictly comply with the foregoing is deemed a waiver of the Contractor's right to request the Meet and Confer and the Non-Binding Mediation procedures under Section 9204. If the Contractor strictly complies with the foregoing, the District will schedule the Meet and Confer conference within thirty (30) days of the Contractor's Meet and Confer request for settlement of disputed portions of the Claim Review Statement.

16.11.2.4.2 Meet and Confer Statement. Within ten (10) business days after conclusion of the Meet and Confer conference, if any portion of a Claim remains disputed, the District shall provide the Contractor a written statement identifying the disputed and undisputed portions of the Claim ("Meet and Confer Statement"). If the Meet and Confer Statement identifies any Undisputed Claim and payment is due from the District on the Undisputed Claim, the District shall process and make payment on the Undisputed Claim within sixty (60) days after date the Meet and Confer Statement is issued.

16.11.2.5 Non-Binding Mediation.

16.11.2.5.1 Contractor Initiation. The Contractor may request nonbinding mediation ("Mediation") of disputed portions of a Claim identified in the Meet and Confer Statement. The Contractor's Mediation demand must be submitted to the District: (i) in writing; (ii) by registered mail or certified mail, return receipt requested; (iii) within ten (10) days after the Meet and Confer Statement is submitted to the Contractor; and (iv) with specific identification of the disputed Claims issues subject to Mediation. Failure of the Contractor to strictly comply with the foregoing is deemed a waiver of the Contractor's right to demand Mediation procedures under Section 9204.

16.11.2.5.2 Mediator Selection. The District and Contractor shall mutually agree to a mediator within ten (10) business days after the date of the Contractor's demand for Mediation. If the District and Contractor do not mutually agree to a mediator, the District and Contractor shall each select a mediator and the District/Contractor selected mediators shall select a qualified neutral third party to mediate the disputed portion of the Claim.

16.11.2.5.3 Mediation Procedures. Mediation includes any nonbinding process, including, but not limited to, neutral evaluation or a dispute review board, in which an independent third party or board assists the District and Contractor in dispute resolution through negotiation or by issuance of an evaluation.

16.11.2.5.4 Mediation Costs. All costs, fees and expenses of the mediator(s) and mediation administration shall be shared equally

by the District and Contractor. The foregoing notwithstanding, the Contractor and District shall each bear the costs, fees and expenses of their own attorneys, experts and consultants.

16.11.2.5.5 Post-Mediation Disputed Claims. Any Claims issues in dispute after Mediation shall be resolved in accordance with the applicable provisions of the Contract Documents.

16.11.2.5.6 Waiver. The District and Contractor may mutually agree to waive, in writing, Mediation under Section 9204 and subject to the Contractor's compliance with Government Code Claim requirements, proceed directly to commencement of a civil action or binding arbitration.

16.11.2.6 Payments of Undisputed Claims. If a payment due from the District for Undisputed Claims identified in the Claim Review Statement or the Meet and Confer Statement issued for a Claim is not made within the time established under Section 9204 the overdue portion of such payment shall bear interest at the rate of seven percent (7%) per annum from the date due. The District's credit application of any amount due for an Undisputed Claim against amounts due from the Contractor under the Contract Documents shall be deemed payment of the Undisputed Claim.

16.11.2.7 Subcontractor Claims.

16.11.2.7.1 Subcontractor Claim Submittal. If a Subcontractor, of any tier (collectively "Subcontractor") lacks legal standing to assert a Claim against the District because privity of contract does not exist, the Contractor may present the District a Claim on behalf of the Subcontractor ("Subcontractor Claim"). Each Subcontractor requesting submittal of a Subcontractor Claim to the District shall furnish reasonable documentation to support the Subcontractor Claim. Within forty-five (45) days of receipt of a Subcontractor's written request to submit a Subcontractor Claim, the Contractor shall notify the Subcontractor in writing as to whether the Contractor presented the Subcontractor Claim to the District. If the Contractor did not present the Subcontractor Claim, the Contractor shall provide the Subcontractor with a statement of the reasons for not having done so.

16.11.2.7.2 Contractor Certification of Subcontractor Claim. The District's review of Subcontractor Claims is expressly subject to the Contractor's submittal of a duly completed and executed form of Contractor Certification of Subcontractor Claim certifying that the Contractor has thoroughly reviewed the Subcontractor Claim and based on the Contractor's review, certify that: (i) the Subcontractor Claim is made by the Subcontractor in good faith; (ii) the Subcontractor Claim is supported by reasonable documentation establishing entitlement to the relief requested and District liability therefor; and (iii) the Subcontractor Claim does not incorporate any request constituting a False Claim under applicable law, including the California False Claim Act (Government Code §12650 et seq). The form of Contractor Certification of Subcontractor Claim is included in the Contract Documents.

16.11.2.7.3 District Review of Subcontractor Claim. Subcontractor Claims presented by the Contractor to the District are subject to the Section 9204 non-binding dispute resolution procedures set forth above, as modified herein. Requests for the District to conduct Meet and Confer and/or non-binding mediation procedures must be submitted jointly by the Contractor and the Subcontractor submitting the Subcontractor Claim. If Mediation proceedings are initiated in connection with a Subcontractor Claim, mediator and mediation administration fees and costs shall be borne equally by the District, Contractor and Subcontractor.

16.11.2.7.4 Disputed Subcontractor Claims. Subcontractor Claims which are not fully resolved by the Section 9204 non-binding dispute resolution procedures shall be resolved by Section 20104.4 Dispute Resolution Procedures or binding arbitration, as applicable. Commencement of Section 20104.4 Dispute Resolution Procedures or binding arbitration proceedings in connection with any Subcontractor Claim is subject to compliance with Government Code Claims requirements.

16.11.3 Government Code Claim Requirements. Pursuant to Government Code §930.6, any claim, demand, dispute, disagreement or other matter in controversy asserted by the Contractor, whether on behalf of itself or a Subcontractor, against the District for money or damages, including without limitation Claims or portions thereof remaining in dispute after completion of the Section 9204 non-binding dispute resolution procedures described above are deemed a "suit for money or damages" and shall be subject to the provisions of Government Code §§945.4, 945.6 and 946 ("Government Code Claims Process"). An express condition precedent to the Contractor's initiation of Section 20104.4 Dispute Resolution Procedures or binding arbitration proceedings pursuant to the following is the Contractor's compliance with the Government Code Clams Process, including without limitation, presentation of the claim, demand, dispute, disagreement or other matter in controversy between the Contractor and the District seeking money or damages to the District and acted upon or deemed rejected by the District in accordance with Government Code §900, et seq.

16.11.4 Section 20104.4 Dispute Resolution Procedures; Claims Less Than $375,000. Any Claim, or portion thereof, in dispute after completion of the Section 9204 non-binding dispute resolution procedures and the Government Code Claims Process which is equal to or less $375,000 shall be resolved in accordance with the civil action procedures established in Public Contract Code §20104.4. Unless otherwise agreed to by the District and the Contractor in writing, the mediation conducted pursuant to Section 9204 procedures shall excuse any further obligation under Section 20104.4 to mediate after litigation has been commenced.

16.11.5 Binding Arbitration of Claims Exceeding $375,000.

16.11.5.1 JAMS Arbitration. Any Claim, or portion thereof in dispute after completion of the Section 9204 procedures and the Government Code Claims Process which exceeds $375,000 and any other claims, disputes, disagreements or other matters in controversy between the District and the Contractor arising out of, or related, in any manner, to the Contract Documents, or the interpretation, clarification or enforcement thereof shall be resolved by binding arbitration conducted before one (1) retired judge

in accordance with the Construction Arbitration Rules and Procedures of Judicial Arbitration Mediation Services ("JAMS") in effect as of the date that a Demand for Arbitration is filed, except as expressly modified herein. The locale for any arbitration commenced hereunder shall be the regional office of the JAMS closest to the Site.

16.11.5.2 Demand for Arbitration. A Demand for Arbitration shall be filed and served within a reasonable time after the occurrence of the claim, dispute or other disagreement giving rise to the Demand for Arbitration, but in no event shall a Demand for Arbitration be filed or served after the date when the institution of legal or equitable proceedings based upon such claim, dispute or other disagreement would be barred by the applicable statute of limitations. If more than one Demand for Arbitration is filed by either the District or the Contractor relating to the Work or the Contract Documents, all Demands for Arbitration shall be consolidated into a single arbitration proceeding, unless otherwise agreed to by the District and the Contractor. The Contractor's Surety, a Subcontractor or Material Supplier to the Contractor and other third parties may be permitted to join in and be bound by an arbitration commenced hereunder if required by the terms of their respective agreements with the Contractor, except to the extent that such joinder would unduly delay or complicate the expeditious resolution of the claim, dispute or other disagreement between the District and the Contractor, in which case an appropriate severance order shall be issued by the Arbitrator.

16.11.5.3 Discovery. In connection with any arbitration proceeding commenced hereunder, the discovery rights and procedures provided for in California Code of Civil Procedure §1283.05 shall be applicable, and the same shall be deemed incorporated herein by this reference.

16.11.5.4 Arbitration Award. The award rendered by the Arbitrator ("Arbitration Award") shall be final and binding upon the District and the Contractor only if the Arbitration Award is: (i) supported by substantial evidence; (ii) based on applicable legal standards in effect that the time the Arbitration Award is issued; and (iii) supported by written findings of fact and conclusions of law in conformity with California Code of Civil Procedure §1296. Any Arbitration Award that does not conform to the foregoing is invalid and unenforceable. The District and Contractor hereby expressly agree that the Court shall, subject to California Code of Civil Procedure §§1286.4 and 1296, vacate the Arbitration Award if, after review, the Court determines either that the Arbitration Award does not fully conform to the foregoing. The confirmation, enforcement, vacation or correction of an arbitration award rendered hereunder shall be made by the Superior Court of the State of California for the county in which the Site is situated. The substantive and procedural rules for such post-award proceedings shall be as set forth in California Code of Civil Procedure §1285 et seq.

16.11.5.5 Arbitration Fees and Expenses. The expenses and fees of the Arbitrator shall be divided equally among all of the parties to the arbitration. Each party to any arbitration commenced hereunder shall be responsible for and shall bear its own attorneys' fees, witness fees and other costs or expenses incurred in connection with such arbitration. The foregoing notwithstanding, the Arbitrator may award arbitration costs,

including Arbitrator's fees but excluding attorneys' fees, to the prevailing party. By this arbitration provision, the District and the Contractor acknowledge and agree that neither shall recover from the other any attorney's fees associated with or arising out of any legal, administrative or other proceedings filed or instituted in connection with or arising out of the Contract Documents or the performance of either the District or the Contractor thereunder. The limited exceptions in the Contract Documents that provide attorney's fees for specific issues shall neither be construed as applying to this arbitration provision under California Civil Code § 1717(a) nor be deemed to be "authorized by the Laws."

16.11.5.6 Limitation on Arbitrator. The Superior Court for the State of California for the County in which the Project Site is situated has the sole and exclusive jurisdiction, and an arbitrator has no authority, to hear and/or determine a challenge to the commencement or maintenance of an arbitration proceeding on the grounds that: (i) the subject matter of the arbitration proceeding is barred by the applicable statute of limitations; (ii) the subject matter of the arbitration proceeding is barred by a provision of the California Government Claims Act; (iii) the subject matter of the arbitration proceeding is outside the scope of the arbitration clause; (iv) the Contractor has failed to satisfy all conditions precedent to commencement or maintenance of ab arbitration proceeding; (v) waiver of the right to compel arbitration; (vi) grounds exist for the revocation of the arbitration agreement; and/or, (vii) there is the prospect that a ruling in arbitration would conflict or potentially with a ruling in a pending proceeding regarding the Project on a common issue of law or fact.

16.11.6 Inapplicability to Bid Bond. The arbitration proceedings described above are not applicable to disputes, disagreements or enforcement of rights or obligations under the Bid Bond. All claims, disputes and actions to enforce rights or obligations under the Bid Bond shall be adjudicated only by judicial proceedings commenced in a court of competent jurisdiction.

16.12 Limitation on Special/Consequential Damages. In the event of the District's breach or default of its obligations under the Contract Documents, the damages, if any, recoverable by the Contractor shall be limited to general damages which are directly caused by the breach or default of the District and shall exclude any and all special or consequential damages, if any. The Contractor expressly acknowledges the foregoing limitation to recovery of only general damages from the District if the District is in breach or default of its obligations under the Contract Documents; the Contractor expressly waives and relinquishes any recovery of special or consequential damages from the District.

16.13 Capitalized Terms. Except as otherwise expressly provided, capitalized terms used in the Contract Documents shall have the meaning and definition for such term as set forth in the Contract Documents.

16.14 Attorney's Fees. Except as expressly provided for in the Contract Documents, or authorized by the Laws, neither the District nor the Contractor shall recover from the other any attorney's fees or other costs associated with or arising out of any legal, administrative or other proceedings filed or instituted in connection with or arising out of the Contract Documents or the performance of either the District or the Contractor thereunder.

16.15 Provisions Required by Law Deemed Inserted. Each and every provision of law and clause required by law to be inserted in the Contract Documents is deemed to be inserted herein

and the Contract Documents shall be read and enforced as though such provision or clause are included herein, and if through mistake, or otherwise, any such provision or clause is not inserted or if not correctly inserted, then upon application of either party, the Contract Documents shall forthwith be physically amended to make such insertion or correction.

16.16 Prohibited Interests. No employee of the District, who is authorized in such capacity on behalf of the District to negotiate, make, accept or approve, or to take part in negotiating, making, accepting or approving any architectural, engineering, inspection, construction or material supply contract or subcontract in connection with the Work shall become directly or indirectly financially interested in the Work or any part thereof.

16.17 Days. Unless otherwise expressly stated, references to “days” in the Contract Documents shall be deemed to be calendar days.

16.18 Entire Agreement. The Contract Documents contain the entire agreement and understanding between the District and the Contractor concerning the subject matter hereof, and supersedes and replaces all prior negotiations, proposed agreements or amendments, whether written or oral. No amendment or modification to any provision of the Contract Documents shall be effective or enforceable except by an agreement in writing executed by the District and the Contractor.

[END OF SECTION]

SPECIAL CONDITIONS

Û Application of Special Conditions. These Special Conditions form a part of the Contract! Documents for the Work generally described as: **Instructional Building 2, Bid No. CCC-055**.

Ú Contract Time. The Contract Time for Substantial Completion of the Work is (694) six! hundred ninety four calendar days after the date for commencement of the Work, as set forth in! the Notice to Proceed issued by or on behalf of the District to the Contractor.

Ò Liquidated Damages. The per diem rate of Liquidated Damages for delayed Substantial! Completion, delayed submission of Submittals and delayed completion of Punchlist shall be as set! forth herein..

3.1. Delayed Substantial Completion. If Substantial Completion is not achieved on or before expiration of the Contract Time, the Contractor shall be liable to the District for Liquidated Damages from the date of expiration of the Contract Time to the date that the Contractor achieves Substantial Completion of the Work is Fifteen hundred Dollars ($1,500.00) per day.

3.2. Delayed Submission of Submittals. If the Contractor fails to submit a Submittal in accordance with the Submittal Schedule, the Contractor shall be liable to the District for Liquidated Damages for each delayed Submittal at the rate of Five Hundred Dollars ($500.00) per day from the date that such Submittal was due to be submitted pursuant to the Submittal Schedule and the date that the Contractor actually submits the Submittal to the Architect.

3.3. Delayed Punchlist. If the Contractor fails to complete Punchlist within the time established pursuant to the Contract Documents, the Contractor shall be liable to the District for Liquidated Damages from the planned Punchlist Completion date to the actual Final Completion date that at the rate of Fifteen Hundred Dollars ($1,500.00) per day from the date established for completion of Punchlist until the date that all Punchlist is actually completed.

3.4. Surety Liability. Subject only to limitations established by the penal sum of the Performance Bond, the Surety issuing the Performance Bond shall be liable to the District for Liquidated Damages due from the Contractor.

4. Copies of Agreement and Bonds. The number of required executed copies of the Agreement is three (3) and the number of required executed copies of the Performance Bond, and the Payment Bond is three (3).

5. Construction Manager. The Construction Manager is PCM3, Inc.

6. District Furnished Drawings and Specifications. Pursuant to Article 2.1.3 of the General Conditions, the District will furnish to the Contractor for use solely and exclusively in connection with performance of the Work zero (0) printed copies of the Drawings and Specifications. Additional copies of the Drawings and Specifications may be reproduced by the Contractor at its cost.

7. Hours and Days of Work at the Site.

7.1. Hours of work at the Site shall be subject to limitations established by the City of Compton and the Compton Community College District. Work at the site is allowed every day of every month. In general, hours shall be between 7:00 AM and 4:00 PM on a daily basis. Contractors are allowed to start setting up at 6:00 AM as long as noise does not start before 7:00 AM.

7.2. Limitations on Work Hours/Days. Work activities at the Site will be limited or prohibited on days: (i) devoted to student testing or when testing of students may be adversely affected by Work activities at the Site; or (ii) when other special events or

functions are scheduled. The Contractor shall familiarize itself with District activities at the Site to avoid Work activity interferences or disturbances to such District activities. The Contractor's Construction Schedule shall take into account the District activities which limit or preclude Work activities at the Site. The 2018 - 2019 Academic Calendars are attached hereto as Attachment A to the Special Conditions and incorporated herein for the Contractor's reference and use.

8. Contractor Personnel Parking. Contractor vehicles must display an Compton Community College District parking permit on the dashboard of the vehicle at all times while parked on District property if parking outside their project fence-line. Vehicles failing to display the required permit will be cited. Permits may be purchased from the daily parking permit machines. Limited parking will be available within the perimeter of the Site without cost or charge to the Contractor, on a first-come, first-served basis. Additional parking is available in District parking lots; parking of motor vehicles in District parking lots is subject to daily parking charges and compliance with District parking lot rules and regulations. No adjustment of the Contract Time or the Contract Price shall be allowed on account of limited parking within the Site or for parking in the District's parking lots.

9. Site Perimeter Fencing. The Contractor shall install a chain link fence with fabric privacy screen around the entire perimeter of the Site to prevent dust and debris being blown from the construction area into adjacent areas, including without limitation, adjacent streets and residential areas. Without adjustment of the Contract Time or the Contract Price the Contractor shall maintain all fencing in good condition and clear of any graffiti or damage. The Contractor shall remove or relocate such fencing as directed by the District or the Construction Manager.

10. Project Signage and Barricades. In addition to safety signage required per General Conditions 4.9.3, the Contractor shall furnish and install and maintain additional project signage as set forth in the Contract Documents.

11. Facilities/Services for Project Inspector. Pursuant to Article 4.14 of the General Conditions, during the Work, the Contractor shall provide/furnish the following facilities/services or other items for use by the Project Inspector: (See Attachment B). All costs, fees, expenses or other charges for the listed items on Attachment B are included within the Contract Price.

12. District Provided Temporary Utilities. Pursuant to Article 4.3.4 of the General Conditions, during the Contractor's performance of the Work, the District will not provide utility services and a point of connection for electrical power and domestic potable water utility services. The connection and placement, relocation and removal of temporary distributions of the electrical power and domestic potable water utility service provided by the District will be by the Contractor at its cost and expense without adjustment of the Contract Price. The Contractor may use the temporary electrical power and domestic potable water service furnished by the District provided that: (i) the District may discontinue, limit or condition use of such services by a Contractor if the District reasonably determines that the Contractor has wasted such utilities, and (ii) the District shall not be liable to the Contractor, nor shall the Contract Time or the Contract Price be increased if any District provided temporary utility service is discontinued or disrupted for any reason other than the District's non-payment of undisputed utility charges. Notwithstanding any provision of the Contract Documents to the contrary, the Contractor shall not use District provided water supply in connection with any earthwork or grading operations; water supply for earthwork or grading operations shall be obtained by the Contractor, without adjustment of the Contract Time or the Contract Price, from an off-site source or mobile water delivery service.

13. Mark-Ups on Changes to the Work. In the event of Changes to the Work, pursuant to Article 9 of the General Conditions, the mark-up for all overhead (including home and field office overhead), general conditions costs and profit, shall not exceed the percentage of allowable direct

actual costs for performance of the Change as set forth below.

13.1. Subcontractor Performed Changes. For the portion of any Change performed by Subcontractors of any tier, the maximum allowable mark-up percentage on actual direct labor and materials costs incurred by all Subcontractors of any tier shall be Ten Percent (10%). In addition, for the portion of any Change performed by a Subcontractor of any tier, the Contractor may add an amount equal to Five Percent (5%) of the allowable actual direct labor and materials costs of Subcontractors performing the Change; the foregoing mark-up shall not be applied to the Subcontractor mark-up.

13.2. Contractor Performed Changes. For the portion of any Change performed by the Contractor's own forces, the mark-up on the allowable actual direct labor and materials costs of such portion of a Change shall be Fifteen Percent (15%).

13.3. Bond Premium Costs. In addition to the foregoing mark-ups on the direct costs of labor and materials, a bond premium expense in an amount equal to the lesser of the Contractor's actual bond premium rate or one percent (1%) of the total actual direct costs of labor and materials (before Subcontractor and Contractor mark-ups) will be allowed. The Bond premium costs are not subject to mark-up.

13.4. Exclusions From Mark-Up of Actual Costs. Mark-ups on the actual cost of materials/equipment incorporated into a Change or for purchase/rental of Construction Equipment shall not be applied to any portion of such costs which are for sales, use or other taxes arising out of the purchase of materials/equipment and/or for purchase/rental of Construction Equipment.

14. Use of Project Allowance.

14.1. The Allowance is used only as directed by the Owner.

14.2. The Allowance is used exclusively for the Owner's purposes and for scope(s) of work as directed by Owner.

14.3. The sub-contractor will prepare detailed breakdown of all costs associated with the work defined for the Allowance. These amounts will be charged against the Allowance by Change Order, based on final detailed payment receipts and back-up as required by Architect/Engineer, and will include all costs of work performed under the defined work scope. If required by Owner, Contractor shall obtain quotes for equipment from three separate vendors and present to District for consideration and selection.

14.4. Contractor shall include in the base bid contract amount all cost of coordination, supervision, bond costs, overhead and profit, supervision, installation and all indirect project costs associated with performing the work of each Allowance. Contractor shall be permitted to charge only its direct costs to perform the work, as indicated through documentation approved by the District.

14.5. At project closeout, any unused Cash Allowance amounts shall be credited to the Owner by Change Order. Contractor shall not deduct costs such as bond costs, overhead and profit or other indirect costs when returning any unused Cash Allowance amounts.

14.6. Changes that exceed the scope of work or amount of each Allowance covered by

each allowance will be processed as a Change Order per Contract Documents.

15. Rain Days. The Contractor's Construction Schedules prepared pursuant to Article 7 of the General Conditions shall incorporate the Rain Days set forth below; there shall be no adjustment to the Contract Time on account of unusually severe weather conditions resulting from rainfall until the actual number of Rain Days exceeds the number of Rain Days set forth below. The Contractor's Construction Schedule shall incorporate the following number of Rain Days for each Calendar Month of the Contract Time:

Month	Rain Days
January	four (4)
February	four (4)
March	three (3)
April	two (2)
May	two (2)
June	none
July	none
August	none
September	none
October	two (2)
November	three (3)
December	four (4)

16. Contractor Obtained Permits. In addition to permits or approvals obtained by the District for the Work, the Contractor shall obtain the following permits, approvals and other authorizations from any public agency with jurisdiction over any portion of the Work. The Contractor shall obtain the permits, approvals and/or authorizations set forth below: (i) without adjustment of the Contract Price, unless otherwise indicated below; and (ii) without adjustment of the Contract Time.

Contractor Obtained Permit, Approval or Authorization	Cost Reimbursement
Deferred Approval Items	**No reimbursement to Contractor; cost included in Contract Price.**

17. Utility Services Disruption. If any portion of the Work requires the cessation, limitation or other disruption to utility services (including without limitation, electrical power, voice/data services, water, sewer, storm drain, or gas) serving any portion of the District's Compton Community College District, the Contractor shall not commence such Work without 72 hours' prior written notice to the District of the extent and nature of utility service cessation, limitation or disruption and written approval by the District to proceed with such Work. The District's approval of any cessation, limitation or disruption of utility services may be denied, granted or conditioned in the sole and exclusive discretion of the District. The foregoing may include, without limitation, approval conditioned on the Contractor providing temporary utility services and distribution thereof during the cessation, limitation or disruption of utility services during; any such temporary utility services and distributions thereof shall be at the cost and expense of the Contractor without adjustment of the Contract Price or the Contract Time.

18. Vegetation Removal/Vegetation Trimming. All activities relating to the removal of any existing

vegetation in or about the Site shall be coordinated with the District pursuant to such limitations, restrictions or conditions established by the District. Prior to any vegetation removal activities, each Contractor and its Subcontractor performing any portion of the vegetation removal or related activities shall meet and confer with the District to establish the scope of removal/trimming. If a Contractor removes or trims vegetation materials without having engaged in such meet and confer with the District and the District's designation of the scope and extent of removal/trimming, the Contractor shall be responsible for all costs, fees and expenses to replace the removed/trimmed vegetation materials as directed by the District.

19. Existing Improvements/Conditions.

19.1. Verification of Existing Improvements/Conditions. Prior to commencement of any portion of the Work, the Contractor shall review the Contract Documents and the existing improvements/conditions in, on or about the area(s) for such portion of the Work to confirm that the actual existing improvements/conditions are consistent with the existing improvements/conditions depicted in the Contract Documents. If any discrepancies exist between actual existing improvements/conditions and those depicted in the Contract Documents, the Contractor shall, prior to commencement of Work in such area notify the District Representative and the Architect, in writing of such variation; as necessary or appropriate, the Contractor shall obtain clarification or direction from the District Representative and/or the Architect to address such variations.

19.2. Damage or Destruction to Existing Improvements/Conditions. If any portion of the Work results in damage or destruction to any existing improvements or conditions in, on or about the Site, the Contractor shall: (i) notify the District Representative and the Architect in writing within four (4) hours of the occurrence of an event of damage or destruction and (ii) repair, replace or otherwise correct such damage/destruction and restore the existing improvements/conditions to the condition existing immediately prior to such damage or destruction at the sole cost and expense of the Contractor without adjustment of the Contract Price or the Contract Time. The foregoing notwithstanding, the Contractor shall not, and shall not permit others to, backfill or cover-up any damage or destruction to existing improvements/conditions without prior notice by the Contractor to the District of backfilling or covering-up of damage/destruction and the District's authorization to proceed with backfilling or covering-up.

19.3. No Use of Existing Facilities. The personnel of the Contractor, Subcontractors and other performing Work at the Site shall not use any existing facilities, improvements in, on or about the Compton Community College District campus, including without limitation, trash/rubbish bins/dumpsters, restrooms, food service areas, loading/storage areas and other similar areas.

19.4. Vehicular Access. Construction activities which limit or prevent access to existing vehicular roadways or existing parking areas shall be performed only during non-school hours. Performance of Work in such areas during non-school hours shall be without adjustment of the Contract Price or the Contract Time.

19.5. Fire, Police, Emergency Access. Each Contractor shall at all times during the Work provide unimpeded vehicular access for the police, fire and other emergency services in and around the Site and adjacent areas. Each Contractor shall provide the District, Construction Manager and any other public agency designated by the District with keys/codes/card keys to all Site perimeter locks.

20. Demolition Materials.

20.1. Demolition Materials Categories. All demolished materials/equipment shall be separated by the Contractor into three (3) categories: (i) concrete and concrete type materials; (ii) steel and other metals; and (ii) general trash.

20.2. Recycling of Demolition Materials. Each Contractor and each of its Subcontractors engaged in any portion of the demolition work shall: (i) recycle concrete/concrete type and steel/metal materials; and (ii) maintain recycling records/submit recycling reports as set forth herein. All concrete/concrete type and steel/metal demolition materials shall be recycled at appropriate recycling centers and/or locations. Each Subcontractor engaged in any portion of the demolition work shall submit a written report to the Contractor upon completion of its demolition activities at the Site. Each report shall include: (i) the name of the Contractor/Subcontractor; (ii) address/telephone of the Contractor/Subcontractor; (iii) date(s) of demolition materials removed; (iv) estimated weight of demolition materials removed from the Site; (v) type(s) of demolition materials removed from the Site; and (vi) the disposal location. Each Contractor shall compile the foregoing reports prepared by its Subcontractor and submit to the District and Construction Manager a comprehensive report of demolition materials types, removal and disposition prior to Final Payment. The Contractor's obligations under the preceding sentence are material and each Contractor's submission of the comprehensive report summarizing the reports of its Subcontractors activities relating to demolition materials and the removal, disposal or recycling thereof is an express condition precedent to the District's obligation to disburse the Final Payment and each Contractor's right to receive the Final Payment. The Contractor shall submit to District with each progress payment application a written report or manifest detailing all recycled and demolished materials removed from the Project during the progress payment period.

21. Waste Disposal. No Contractor or any Subcontractors of any tier are permitted to use District dumpsters or waste disposal services for removal of waste and debris resulting from the Work. Each Contractor must, without adjustment of the Contract Price, provide for the removal of waste/debris materials from the Site with its own forces or with its own retained waste/debris removal service.

22. Discovery of Archeological Resources. If, during the Work, the Contractor encounters materials which are or may be an Archeological Resource (as that term is used and defined in California Public Resources Code §21083.2), the Contractor shall take action as set forth herein.

22.1. Contractor Responsibility. Upon encountering such materials, the Contractor shall: (i) immediately cease Work and any other activity which will or may result in disturbances of the area(s) where such materials are encountered; (ii) immediately notify the Architect, Project Inspector and District in writing of the encountering of such materials; and (iii) take appropriate measures, including any directed or authorized by the District to cordon-off the area(s) in which such materials are encountered to prevent access to, and further disturbance of such area(s), pending determination of whether such materials are Archeological Resources and direction from the District regarding resumption of Work in such area(s).

22.2. District Investigation. Upon receipt of such written notice from the Contractor, the District shall promptly investigate and determine whether the materials encountered constitute Archeological Resource(s), and if so, whether such materials are Unique or Non-Unique Archeological Resources. Upon completing such investigation, the District shall notify the Contractor in writing of the results of such investigation, along with direction for resumption of the Work or further suspension of the Work in such area(s), pending completion of archeological mitigation measures.

22.3. Contractor Continuation of Work. If it is determined that the materials are not Archeological Resources or are Non-Unique Archeological Resources (as that term is used and defined in California Public Resources Code §21083.2(h)), the District

shall notify the Contractor in writing of such conclusion. Upon receipt of such notice from the District, the Contractor shall immediately resume the Work in the area(s) where potential Archeological Resources were encountered. If it is determined that the materials are Unique Archeological Resources (as that term is used and defined in California Public Resources Code 12083.2(g), the District shall notify the Contractor in writing of such conclusion. In such event, the Contractor shall defer further Work in such area(s) pending the District's completion of archeological mitigation measures and direction or authorization from the District to resume Work in such area(s)

22.4. Adjustment of Contract Time for Encountering Actual or Potential Archeological Resources. If the Contractor encounters materials which are or may be Archeological Resources and the Work is suspended pending the District's investigation of such materials to ascertain whether or not such materials constitute Archeological Resources and the suspension of Work in such area(s) directly delays performance of activities on the Critical Path of the then current Master Project Schedule, such suspension of the Work shall be deemed an Excusable Delay (as that term is used and defined in Article 7.4.1 of the General Conditions). The Contractor shall be entitled to an adjustment of the Contract Time to the extent that the Contractor's Critical Path activities are delayed by such suspension. The Contract Price due the Contractor shall not be subject to increase or other adjustment on account of suspension of Work as a result of encountering materials which are or may be Archeological Resources.

22.5. Adjustment of Contract Time for Encountering Unique Archeological Resources. If the Contractor encounters materials which are determined to be Unique Archeological Resources and the Work is suspended pending the District's archeological mitigation activities and the suspension of Work in such area(s) directly delays performance of activities on the Critical Path of the then current Master Project Schedule, such suspension of the Work shall be deemed an Excusable Delay (as that term is used and defined in Article 7.4.1 of the General Conditions). The Contractor shall be entitled to an adjustment of the Contract Time to the extent that the Contractor's Critical Path activities are delayed by such suspension. The Contract Price due the Contractor shall not be subject to increase or other adjustment on account of suspension of Work as a result of encountering materials which are determined to be Unique Archeological Resources.

22.6. Adjustment of Contract Price. The extent to which, if any, the Contract Price due the Contractor is subject to adjustment as a result of encountering actual or potential Archeological Resources shall be limited as set forth herein. Adjustment of the Contract Price shall be limited to activities necessary to secure the area(s) in which actual or potential Archeological Resources are encountered from further access or disturbances. The extent of adjustment of the Contract Price shall be limited to the allowable costs and mark-ups thereon for Changes to the Work, as set forth in the Contract Documents.

22.7. Contractor Continuation of Work In Other Areas. The foregoing provisions shall not excuse nor limit, waive or modify the Contractor's obligation to diligently proceed with performance of Work in all areas of the Site unaffected by the encountering of materials which may be Archeological Resources.

23. Similar Conditions. The intent of the Contract Documents is to provide a fully functional finished product, complete in every respect. Where a specific detail is not shown, the construction shall be similar to that indicated or noted for similar conditions and cases of construction on this

project. References of notes and details to specific conditions and locations shall not limit their applicability. Materials for similar use shall be of the same type and manufacturer, unless otherwise indicated or specifically specified to be different in the Contract Documents. Any deviation must be approved in writing, by the Architect prior to incorporation into the Work.

24. Applicable Codes. All work shall conform with the most recent edition of the California Building Code as adopted and amended DSA and the Laws. All Work shall conform to all applicable requirements set forth in Titles 21 and 24 of the California Code of Regulations. No part of the Contract Documents shall be construed as requiring or permitting Work contrary to the requirements of the Laws.

25. Handicap Access Regulations. The Contractor and all Subcontractors shall comply with Title 24 of the California Code of Regulations relating to Disabled Access Regulations and ADA, Americans With Disabilities Act Regulations whether or not specifically indicated on the Contract Documents. Where existing paths of travel are interrupted due to construction, the Contractor, without adjustment to Contract Price or Contract Time, shall maintain barrier-free paths of travel.

26. Locked Door Policy. In addition to the security requirements set forth elsewhere in the Contract Documents, the Contractor must adhere to a Locked Door Policy. No building room or site gate shall be left unsecured for any period of time when not occupied by the Contractor and/or after the Contractor's daily work hours.

27. Sex Offender Campus Registration. Pursuant to California Penal Code section 290, subd. (a)(1)(C), all Sex Offenders who reside, or are living as a transient upon, or are enrolled at or employed by, a campus of the University of California, California State University, community college or other institution of higher learning, must register with the campus police department, in addition to registering with the police or sheriff's department having jurisdiction over his or her residence.). In addition, California Penal Code 290, subd. (a)(1)(G), requires that students and employees who reside out of state but go to school or work in California must register as Sex Offenders here if they are required to register in their state of residence. An employee is defined as a person who is employed in California on a full or part-time basis, with or without compensation, for more than fourteen (14) days, or for an aggregate period exceeding thirty (30) days in a calendar year. A student is defined as a person who is registered in an educational institution, as defined in Education Code section 22129, on a full or part-time basis. The student/employee must register in the jurisdiction where he or she attends school or is employed.

28. OCIP Program. The current OCIP Program and OCIP Forms are incorporated as Attachment D to these Special Conditions.

29. Completion of Work. The Contractor shall complete all Work no later than the date set forth in the Contract Documents.

[END OF SECTION]

ACADEMIC CALENDAR
(Attachment A to Special Conditions)

COMPTON COMMUNITY COLLEGE DISTRICT
SCHOOL YEAR CALENDAR
2019-2020

JULY 2019

S	M	T	W	T	F	S
	1	2	3	*4	[5]	[6]
[7]	8	9	10	11	[12]	[13]
[14]	15	16	17	18	[19]	[20]
[21]	22	23	24	25	[26]	[27]
[28]	29	30	31			

NOVEMBER 2019

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	*11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	*28	*29	[30]

MARCH 2020

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

AUGUST 2019

S	M	T	W	T	F	S
				1	[2]	[3]
[4]	5	6	7	8	[9]	[10]
[11]	(12)	(13)	(14)	(15)	(16)	[17]
[18]	(19)	(20)	(21)	{22}	{23}	24
25	26	27	28	29	30	31

DECEMBER 2019

S	M	T	W	T	F	S
[1]	2	3	4	5	6	7
8	9	10	11	12	13	[14]
[15]	(16)	(17)	(18)	(19)	(20)	[21]
[22]	(23)	*24	*25	[26]	[27]	[28]
[29]	[30]	*31				

APRIL 2020

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	[11]
[12]	(13)	(14)	(15)	(16)	*17	18
19	20	21	22	23	24	25
26	27	28	29	30		

SEPTEMBER 2019

S	M	T	W	T	F	S
1	*2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

JANUARY 2020

S	M	T	W	T	F	S
			*1	(2)	(3)	[4]
[5]	6	7	8	9	10	[11]
[12]	13	14	15	16	17	[18]
[19]	*20	21	22	23	24	[25]
[26]	27	28	29	30	31	

MAY 2020

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	*25	26	27	28	29	30
31						

OCTOBER 2019

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

FEBRUARY 2020

S	M	T	W	T	F	S
						[1]
[2]	3	4	5	6	(7)	[8]
[9]	(10)	(11)	{12}	{13}	*14	[15]
[16]	*17	18	19	20	21	22
23	24	25	26	27	28	29

JUNE 2020

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	(12)	[13]
[14]	(15)	(16)	(17)	(18)	(19)	[20]
[21]	22	23	24	25	[26]	[27]
[28]	29	30				

Fall	Winter Intersession	Spring	Flex Days	Summer	No Classes

{ } - Staff Development Flex Days – Campus Remains Open – Classes not in session
( ) – New Full-time Faculty Orientation and Part-Time Faculty Orientation
[ ] - Campus Closed
*** - Holidays (Management, Faculty, Staff, and Students) – Campus Closed
( ) - Campus Remains Open – Classes not in session

Page 1

Contractor Provided Facilities, Services, Furnishings and Equipment for Project Inspector (Attachment B to Special Conditions)

The Contractor shall provide and furnish the following for use by the Project Inspector for the entire duration of the Work at the Site, until Final Completion is achieved. All costs, fees, expenses or other charges for the following are included within the Contract Price.

Site Office Facility	Lockable office with at least 120 sq ft in GC trailer or separate lockable trailer for Project Inspector
Site Office Furnishings	One 3 x 5 desk, 2 chairs, one 3 x 6 plan table, one four drawer filing cabinet, plan rack & hangars capable of holding 3 sets minimum of 30 x 42 drawings.
Site Office Equipment	Desktop printer and cables required for laptop connection
Site Office Services	Power, air conditioning, wireless internet service
Site Office Consumable Materials	Ink cartridges, copy paper as necessary for printer
Other Items/Services	One lockable toilet facility for Architect, CM & PI use only.

Attachment C to Special Conditions:

CONTRACTOR CERTIFICATION OF SUBCONTRACTOR CLAIM

Project Name: _____ Project No:_____

Pursuant to Article 16.11.2.7.2 of the General Conditions, I certify as follows:

1. The portion of the Claim made on behalf of the Subcontractor to which this certification is attached is made in good faith.

2 I have reviewed the attached Subcontractor Claim and certify that to the best of my knowledge and belief, the amounts claimed for costs, expenses and damages incurred and supporting data submitted to CM/Contractor by the Subcontractor on behalf of any and all subcontractors or suppliers to Subcontractor, of all tiers, or any person or entity under Subcontractor, are accurate and complete. Subcontractor will not submit, after the date of execution of this certification, any such supporting data, including any such new amounts that, to the best of my knowledge and belief, that are not accurate and complete.

3. The amount requested accurately reflects the amount for which the Subcontractor believes the District is liable to Contractor.

4. The Subcontractor Claim does not incorporate any request constituting a False Claim under applicable law, including the California False Claim Act (Government Code §12650 et seq).

5. I am duly authorized to certify the Subcontractor Claim on behalf of the Contractor.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

Executed at: _____, in the State of California, on _____, 201_.

_____
(Signature)

_____
(Print Name)

_____
(Title)

_____
(Name of Contractor)

RFQ CCC-055 Instructional Building #2
Attachment D
OWNER CONTROLLED INSURANCE PROGRAM (OCIP)

1.1 INTRODUCTION

The **District**, hereinafter called the "Owner" has elected, at its sole discretion, to implement an Owner Controlled Insurance Program ("OCIP") under the Statewide Educational Wrap Up Program ("SEWUP"). The SEWUP Joint Powers Authority ("JPA") will be providing the OCIP on behalf of the Owner. All terms and conditions of the SEWUP Contractual Provisions will apply during the term of the contract.

The OCIP will be primary to other valid and collectable insurance for the owner and enrolled parties in the program. The SEWUP JPA will provide Workers' Compensation, Employer's Liability, General & Excess Liability, and Contractor's Pollution Liability for all Enrolled Contractors (and their Enrolled Subcontractors of every tier) and other designated parties for work performed at the Project Site (hereinafter called "Project") as well as builder's risk insurance. The Owner agrees to pay all premiums associated with the OCIP, unless otherwise stated in this section and in other contract documents.

Insurance coverage provided under the OCIP is limited in scope and specific to Work performed after the inception date of enrollment into the OCIP. Labor and ongoing operations related to offsite locations are not covered by the OCIP. In addition to any insurance provided by the Owner, all Contractors/Subcontractors will be responsible for providing certain insurance as specified in section 1.7. The Owner recommends that Contractors discuss the OCIP with their insurance agents, brokers or consultants to assure that other proper coverages are maintained, prior to contract acceptance.

Keenan & Associates**,** hereinafter called "Program Administrator", shall administer the OCIP on behalf of the SEWUP JPA. At all times, all Contractors/Subcontractors, shall (a) cooperate with Owner, Program Administrator, and all OCIP insurers, as applicable, and their respective consultants, agents and representatives, in its or their administration of the OCIP and all other terms and conditions described herein and (b) comply with the terms, conditions, warranties, and subjectivities of the insurance policies provided pursuant to the OCIP, including, without limitation, any and all directives and requirements of Owner's and the OCIP insurers' respective consultants, agents and representatives, including, without limitation, any directive or requirement relating to loss control, and quality control, and the closure to Owner's satisfaction of open items on any and all quality control checklists and inventories.

A. Participation in the OCIP

Participation in the OCIP is mandatory but not automatic. Each Eligible Contractor/Subcontractor must follow the guidelines, as specified in section 1.5.

Definitions:

Enrollment: An Eligible Contractor/Subcontractor is considered Enrolled once required documents are received, reviewed and processed by the OCIP Program Administrator to the insurer. (See Sections 1.7 and 1.8)

Contractor: Includes all vendors, suppliers, businesses, persons, or entities and entities which the Owner has engaged directly by contract to perform services relating to the Project.

Subcontractor: Includes all vendors' suppliers, businesses, and other persons or entities that have been engaged by a Contractor to perform, or assist with the performance of, services relating to the Project.

Eligible: Includes all Contractors/Subcontractors providing direct labor on the Project, and excludes Ineligible Contractors, as defined below. Temporary labor services and leasing companies are to be treated as Eligible Contractors.

Ineligible: It is not the intent to insure (but is not limited to): consultants; suppliers; abatement and/or removal of hazardous materials; vendors; materials dealers; surveyors; consultants; guard services; non-construction janitorial services; and truckers, including trucking to the Project where delivery is the only scope of work performed; contractors subbing out

installation who are not performing labor on the project site; and contractors performing landscape maintenance (though landscape work itself is covered). Ineligible parties are required to ensure that any eligible subcontractors who provide on-site labor comply with the OCIP Enrollment Any questions regarding a Contractor's status as "Eligible" or "Ineligible" should be referred by written request to Owner and approved by the Program Administrator

EACH CONTRACTOR/SUBCONTRACTOR MUST INCLUDE THIS DOCUMENT WITH THEIR BID SPECIFICATIONS TO ANY AND ALL SUBCONTRACTORS. Any contractor/subcontractor's failure to comply with the OCIP Administrator and all OCIP requirements shall be considered non-compliant under the contract.

Enrollment of each Contractor's eligible Subcontractors is mandatory. Contractor shall notify Owner and the Program Administrator in writing of the identity of each Subcontractor regardless of enrollment eligibility and shall cause each Subcontractor to notify the Program Administrator in writing of the identity of each of its Sub-subcontractors, prior to such parties' commencement of their portion of the Work and prior to their entry onto the Project. Subcontractors shall not be deemed enrolled until the Program Administrator and OCIP insurers receive and approve a completed Contract Enrollment Form, for each awarded contract. Enrollment is required prior to commencement of on-site activities but no contractor shall be enrolled sooner than 30 days prior to their start date. Each Subcontractor shall be solely responsible for any and all losses, damages, claims, liabilities, and suits arising out of such Subcontractor's failure to enroll, or delay in enrolling, any of its Subcontractors.

Unless otherwise directed by the Owner, Ineligible Contractors and Subcontractors will be required to maintain their own insurance for both on-site and off-site activities and will be required to participate in the Project Safety Program **(See Section 1.16)**. Minimum Insurance and endorsement requirements are located in Section **1.7 & 1.8. Each ineligible contractor must register with the OCIP online portal called Keenan Wrap. All required certificates and endorsements must be supplied via Keenan Wrap.**

B. Project Site and Offsite Premises

Coverages provided by the OCIP are Project Site specific. The Project Site shall be designated by the Owner. The Project Site consists of any and all projects that are endorsed to this policy, which includes the:

1. Ways and means adjoining the endorsed project site.
2. Adjacent locations to the endorsed projects sites where incidental operations are being performed, excluding permanent locations.

With the exception of 1 and 2 mentioned above, off-site locations, labor and ongoing operations are not covered by the OCIP. It will be the responsibility of each Contractor/Subcontractor to maintain off-site insurance, as identified in Section 1.7, which specifies coverage types and minimum limits. Contractor/Subcontractor will promptly furnish to the Owner, or its designated representative, Certificates of Insurance evidencing that all required insurance is in force.

1.2 PREQUALIFICATION & COST IDENTIFICATION

A. Contractor Pre-Qualification

Pursuant to Government Code Section 4420.5, Bidders must meet certain minimum standards to bid on the Owners' Project. The following qualification standards apply to ALL Bidding Contractors at time of bid opening:

1. **Shall have an average Workers' Compensation Experience Modification Rate (EMR) of 1.25 or less over the last five (5) years OR the current published year.**

    a. ***We encourage the bidder to choose subcontractors who meet these requirements however this will not exclude eligible subcontractors from enrolling in the OCIP.***

2. **Have Zero (0) Serious and Willful violations (Labor Code Section 6300) against them in the past five (5) years**

3. **Provide evidence of an Injury and Illness Prevention Program (IIPP). Evidence is required to be submitted post bid opening and prior to bid award.**

FAILURE TO MEET THESE MINIMUM STANDARDS SHALL DISQUALIFY THE BIDDER.

B. **Contractor Insurance Cost Identification**
Contractor's base bid shall exclude all costs for insurance coverages provided under the OCIP. If insurance cost is not removed, the bidder may not qualify as the lowest responsive bidder. The Bidder declares under penalty of perjury under California law, that the base bid excludes any costs relating to any insurance coverages afforded under the OCIP and that each subcontractor to the Bidder has similarly excluded costs for any insurance coverage afforded under the OCIP.

C. **Change Order Pricing**
All Contractors/Subcontractors declare, under penalty of perjury under California law, that the change order is priced to exclude any costs relating to any insurance coverage afforded under the OCIP.

1.3 OWNER-PROVIDED INSURANCE COVERAGES

CONTRACTOR/SUBCONTRACTOR SHOULD REFER TO THE ACTUAL POLICIES FOR DETAILS CONCERNING COVERAGE, EXCLUSIONS, AND LIMITATIONS. IN THE EVENT OF ANY CLAIM OR QUESTION REGARDING COVERAGE PROVIDED BY THE OCIP, THE ORIGINAL POLICIES WILL PREVAIL AS THE SOLE BINDING AGREEMENT. OCIP POLICIES AND PROJECT INSURANCE MANUAL ARE AVAILABLE UPON WRITTEN REQUEST TO THE PROGRAM ADMINISTRATOR.

THE OCIP IS INTENDED TO PROVIDE BROAD COVERAGES AND HIGH LIMITS, TO ALL ENROLLED CONTRACTORS/SUBCONTRACTORS. THE OWNER DOES NOT WARRANT OR REPRESENT THAT THE OCIP COVERAGES CONSTITUTE AN INSURANCE PROGRAM THAT COMPLETELY ADDRESSES THE RISKS OF THE CONTRACTORS/SUBCONTRACTORS. PRIOR TO CONTRACT AWARD, IT IS THE RESPONSIBILITY OF ALL CONTRACTORS/SUBCONTRACTORS TO ENSURE THAT THE OCIP COVERAGES PROVIDED SUFFICIENTLY ADDRESS THEIR INSURANCE NEEDS. UPON REQUEST, OCIP POLICIES ARE AVAILABLE FOR REVIEW.

OCIP coverage applies only to Work performed under the contract at the Project (see Section 1.1, B for definition). All Contractors must provide their own insurance for Automobile Liability and off-site locations, labor, and operations.

Such policies or programs may be amended from time to time, and the terms of such policies or programs, as amended, are incorporated herein by reference.

The Contractors/Subcontractors enrolled in the OCIP agree that the OCIP policies' limits of liability, coverage terms and conditions shall determine the scope of coverage provided by the OCIP. As of October 1, 2019, 100% of the limits are available with a minimum of $640 Million in construction values to be insured.

A. **Workers' Compensation and Employer's Liability Insurance, will be provided in accordance with applicable state laws, to all Enrolled Contractors/Subcontractors, each as named insured, and issued an individual policy) reflecting the following Limits of Liability:**

Workers' Compensation:

- California Statutory Benefits

Employer's Liability:

- $1,000,000 Bodily Injury each Accident
- $1,000,000 Bodily Injury by Disease – Policy Limit
- $1,000,000 Bodily Injury by Disease – Each Employee

1. Deductible: None

2. Exclusions: The known exclusions for this coverage are set forth below:

Bodily Injury Outside US or Canada	Intentional or Aggravated Bodily Injury
Bodily Injury To Any Member of Flying Crew	Obligations Imposed By Disability Benefits or Any Similar Law
Bodily Injury To Person Subject To Federal Workers' Compensation	Obligations Imposed By Occupational Disease Laws
Bodily Injury To Person Subject To Occupational Disease Laws	Obligations Imposed By Unemployment Compensation Laws
Contractual Liability	Obligations Imposed By Workers' Compensation Laws
Employees Knowingly Employed Illegally	State or Federal Law Violation Fines, Penalties
Employment Related Practices	

This is a summary and may not be exhaustive. The policy language may contain additional exclusionary language, limitations or carve-backs that are not identified on the table. It is the responsibility of the Contractor/Subcontractor to review the policy for the complete details of all exclusions.

3. **Policy Term**: The master policy effective date is October 1, 2019. The policy term is three years, with automatic one-year renewals until the Project is completed. The policy is intended to remain in effect for duration of the contractor's contractual work. Warranty work and post contract repair work is excluded. Each Contractor/Subcontractor is insured under the policy for the length of its work at the Project.

B. General and Excess Liability Insurance is written on an "Occurrence" form under master liability policies. Certificates of Insurance will be provided to all enrolled Contractors/Subcontractors as named insured, with the total limits of liability reflecting the following:

- $125,000,000 Bodily Injury and Property Damage Liability
- $185,000,000 General Aggregate
- $125,000,000 Products and Completed Operations
- 10 Years Completed Operations

1. Deductible: None

2. Exclusions: The known exclusions for this coverage are set forth below:

Aircraft, Auto or Watercraft	Nuclear
Asbestos	Personal and Advertising Bodily Injury
Certain Exclusions to Medical Payments Coverage	Pollution
Certain Exclusions to Personal and Advertising Injury Liability	Prior Continuous, or Progressively Deteriorating Injury or Damage
Certified Acts of Terrorism	Professional Liability
Contractual Liability (Limited Coverage Provided)	Recall of Products, Work Or Impaired Property
Employers Liability	Silica or Silica Mixed Dust
Employment Related Practices	
Expected or Intended Injury	Violation of Statutes Governing Collecting, Transmitting Information
Exterior Insulation and Finish Systems (EIFS) "Subject to Installation Requirements"	Violation of Statutes Governing Email, Fax, Phone Calls
Fungi Or Bacteria	War
Lead	Workers Compensation and Similar Laws
Mobile Equipment	

This is a summary and may not be exhaustive. The policy language may contain additional exclusionary language, limitations or carve-backs that are not identified on the table. It is the responsibility of the Contractor/Subcontractor to review the policy for the complete details of all exclusions.

3. **Policy Term**:

a. The master policy effective date is October 1, 2019. The policy is intended to remain in effect for the length of the Project or through October 1, 2024 at 12:01am, whichever comes first.
b. Ten years Products and Completed Operations coverage.

C. Contractor's Pollution Liability is written on an "Occurrence" form under a master liability policy. Certificates of Insurance will be provided to all enrolled Contractors/Subcontractors, as named insured, reflecting the following Limits of Liability:

- $15,000,000 Per Occurrence / $25,000,000 Policy Aggregate
- Defense cost are outside of limits up to $1M.

1. $10,000 Deductible per Occurrence
2. Contractor/Subcontractor shall be liable, at its expense; to the extent claims payable are attributable to their acts or omissions and/or the acts or omissions of its Subcontractors of any tier or any other entity or person for whom it may be responsible. The deductible will apply to each occurrence and must be satisfied prior to payment of the loss. The deductible amount shall not be reimbursed by the OCIP Insurance Program or the District.
3. Exclusions: The known exclusions for this coverage are set forth below:

Auto, Aircraft, Vessel Or Rolling Stock	Nuclear
Claims Between Certain Insureds	Other Entities
Contractual Liability	Pre-Existing Conditions
Damage To Property	Products
Fines, Penalties, and Treble Damages	War
Employment Related Practices	Workers Compensation and Similar Laws
Owned Hazardous Materials Facility	

This is a summary and may not be exhaustive. The policy language may contain additional exclusionary language, limitations or carve-backs that are not identified on the table. It is the responsibility of the Contractor/Subcontractor to review the policy for the complete details of all exclusions.

4. Policy Term: The master policy effective date is October 1, 2019. The policy is intended to remain in effect for the length of the Project or through October 1, 2024 at 12:01am, whichever comes first.

D. Builder's Risk coverage will be in place during the Course of Construction at the Project. Such insurance shall be written on a repair or replacement cost basis, subject to exclusions, sub limits, property limitations and conditions. Such insurance shall include the interests of the Owner as named insured and enrolled Contractors/Subcontractors as additional insured. The deductible schedule is as follows:

Deductibles

- $10,000 - $50,000 deductible (depending on type of structure) for Wood Frame, Masonry Non-Combustible or Joisted Masonry, and Fire Resistive / Non-Combustible.
- $50,000 deductible for Water Damage to structural renovations.
- $100,000 deductible for Water damage to Large Span Buildings, (with unsupported roof greater than 200 feet); and Stadiums/Arenas (open air, fixed roof, and/or retractable roof).

1. Contractor/Subcontractors shall be responsible for the applicable deductible. The deductible shall apply to each occurrence and must be satisfied prior to payment of the loss. The deductible shall not be reimbursed by the OCIP Insurance Program or the District.

2. Exclusions: The known exclusions for this coverage are set forth below:

Asbestos	Foreign Terrorism
Certain Offsite Property	Infidelity, Dishonesty, Fraudulent Activity of Insured
Certain Release, Discharge, Escape, or Dispersal of Contaminants	Land, Values of Land, Cut, & Fill etc. Prior to Project Commencement
Certified Acts of Terrorism (Optional Coverage)	Loss Under Any Manufacturer or Supplier Guarantee/Warranty
Cessation of Work	Normal Subsidence
Contractor's Tools, Machinery, Plans, Equipment	Nuclear
Cost of Making Good (Optional Coverage)	Offshore or Barrier Island Property
Damage to Existing Property (Optional Coverage)	Property That Stores, Processes, or Handles Radioactive Materia
Damage While Testing Prototype or Used Machinery/Equipment	Rolling Stock, Aircraft, Watercraft
Damages, Fines, Penalties at Government Agency or Court Order	Software Loss, unless results from an Open Peril
Disappearance or When Revealed by Inventory Shortage Alone	Vehicles or Equipment Licensed For Highway Use
Earth Movement (Optional Coverage)	War and Military Action
Electrical, Magnetic, or Errors Related to Electronic Records	Standing Timber, Growing Crops, Animals
Financial Accounts, Instruments, Stamps, Deeds, Precious Material	
Flood (Optional Coverage) (rain and the accumulation of rain water added to Flood definition)	

This builder's risk coverage and exclusion summary may not be all inclusive. The policy language may contain additional exclusionary language, limitations or carve-backs that are not identified on the table. It is the responsibility of the Contractor/Subcontractor to review the policy for the complete details of all exclusions, sublimit and deductibles.

3. Special Conditions: **All wood frame only projects are subject to Protective Safeguards as shown in** EXHIBIT A**.**

4. **Policy Term**: The policy term is the term of the project.

5. *All Contractors'/Subcontractors' shall be responsible for any loss or damage to their personal property. This would include, but is not limited to, tools, equipment, mobile construction equipment, or materials NOT intended to be a permanent part of the building, whether owned, borrowed, used, leased, or rented by any Contractor/Subcontractor. Any insurance purchased by the Contractors/Subcontractors, or self-insurance, shall be the Contractors'/Subcontractors' sole source of recovery in the event of a loss.*

E. OCIP Policies Establish OCIP Coverage. The insurance coverages, limits of liability, definitions, terms, conditions, exclusions and limitations contemplated in these contractual provisions and the other contract documents are set forth in full in the OCIP insurance policies. The summary descriptions of such policies in these contractual provisions, in the Project Insurance Manual, or in any other contract document or elsewhere are not intended to be complete or to alter or amend any provisions of the actual OCIP policies. To the extent, if any, such descriptions herein or therein conflict with any such insurance policies, the provisions of the actual insurance policies shall govern. To the extent there are any other conflicts between or among the provisions of such insurance policies, these contractual provisions, the contract documents, or the Project Insurance Manual, then in descending order, the insurance policies shall govern, followed by these contractual provisions, the contract, the other contract documents, then the Project Insurance Manual. Contractor/Subcontractor acknowledges that it has had the opportunity to review the insurance

policies as provided in **Section 1.3**, and that it is relying solely on the provisions set forth in the insurance policies, and not upon any oral or written statement or reference in these contractual provisions, any other contract document, the Project Insurance Manual, or otherwise.

1.4 OCIP CERTIFICATES AND POLICIES

All Enrolled Contractors/Subcontractors will receive Certificates of Insurance for Workers' Compensation, General Liability, Excess Liability and Contractor's Pollution Liability coverages. Each enrolled Contractor/Subcontractor will receive their own Workers' Compensation policy. Program Administrator will provide a copy of the OCIP policies upon written request. Such policies or programs may be amended from time to time and the terms of such policies or programs, as they may be amended, are incorporated herein by reference. Contractors/Subcontractors hereby agree to be bound by the terms of coverage, as contained in such insurance policies and/or self-insurance programs.

1.5 CONTRACTOR/SUBCONTRACTOR RESPONSIBILITIES

Participation in the OCIP is mandatory but not automatic. Contractor /Subcontractor must comply with the following:

A. Contractor Eligibility, see Section1.1, **A** for definition.

B. Contractor Registration & Enrollment

The Program Administrator will provide online registration via Keenan Wrap, through its proprietary software referred to herein as "Wrap Portal"; a User Name, Password and URL for website enrollment will be provided to each Subcontractor upon entry of Subcontractor identifying information into Wrap Portal by Contractor or Parent Subcontractor regardless of enrollment eligibility.

An Eligible subcontractor is not enrolled until the Program Administrator and OCIP insurers receive and approve a completed OCIP Enrollment via Wrap Portal, for each awarded contract. subcontractor shall also upload declarations pages, including proof of rates from Subcontractor's current policies. Enrollment is required prior to commencement of on-site activities but no Subcontractor shall be enrolled sooner than 30 days prior to their start date. Subcontractors must provide the Required Insurance Coverages (see Sections 1.7 and 1.8) via Wrap Portal.

Any Subcontractor who enrolls in the OCIP after their start date must provide a No- Known-Loss Letter to the Program Administrator, along with the enrollment documentation. Late Enrollment is not guaranteed and must be approved and accepted by the insurance carrier. Upon approval, the Program Administrator will provide evidence of OCIP coverage to the Subcontractor, as noted in Section 1.4

All Subcontractors shall cooperate with, and require their Subcontractors to cooperate with, the Owner and the Program Administrator, in regard to the administration and operation of the OCIP.

C. Contractor/Subcontractor Compliance with Other Forms and Procedures

All Enrolled Contractors/Subcontractors are required to complete and submit the following forms:

1. **Project Site Monthly Payroll Report**
   Project Site Monthly Payroll must be submitted to the Program Administrator by the 10th of each month via Wrap Portal until the completion of the contract and in no event shall be later than the 15th of each month. This report must summarize the unburdened payroll by Workers' Compensation Class Code. Certified payroll is not a requirement of the OCIP and cannot be accepted. **If the Project Site Monthly Payroll Report is not submitted by you or your subcontractor to the Program Administrator, the Contractor, Construction Manager and/or Owner may withhold payment until the report is received.** Subcontractor agrees to keep and maintain accurate and classified records of their payroll for operations at the Project Site.

This payroll information is submitted to the OCIP insurer. At the end of each contract, a carrier audit may be performed using the reported payroll and other supporting documents, as required by the California Workers Compensation Insurance Rating Bureau (WCIRB).

Workers' Compensation Insurance Rating Bureau Requirements

Once an Eligible Contractor/Subcontractor is enrolled into the OCIP, a separate Workers' Compensation Policy will be issued to them. All Enrolled Contractors/Subcontractors shall comply with the rules and regulations of the California Workers Compensation Insurance Rating Bureau (WCIRB).

2. **Contractor's Completion Notice**

Contractor's Completion Notice must be submitted to the Program Administrator via Wrap Portal upon completion of work at the Project, which includes punch list items, but not warranty work. Subcontractor shall cooperate with Contractor in completing the *Contractor's Completion Notice.* This form evidences all enrolled Subcontractors' actual start and completion dates, per each contract. This information is used to confirm that each Workers' Compensation Policy was issued with correct policy term dates, covering the Subcontractors for the duration of their work at the Project. This information is subsequently submitted to the Workers' Compensation Insurance Rating Bureau (WCIRB).

3. **Project Insurance Manual**

A Project Insurance Manual will be provided to all awarded Contractors/Subcontractors, which includes a Program Summary, Claims Reporting Instructions, Project Safety Guidelines, necessary forms, and contact information. Copies can be requested from the Program Administrator.

Contractor/Subcontractor Compliance with all aspects of the OCIP

All Contractors/Subcontractors further acknowledge and agree to comply fully and promptly with such safety, loss control, and quality control rules, requirements, and directives as may from time to time be promulgated by Owner, the Program Administrator and/or the OCIP insurers or any of its or their respective consultants, agents, or representatives. Nothing in this document or any other contract document or in the Project Insurance Manual, shall be deemed to render Owner or any of its affiliates of any tier an employer of Contractor/Subcontractor or any of its Subcontractors or any of its or their personnel or employees. **Failure to comply will be considered non-performance under the contract.**

It is the obligation of each Eligible Contractor/Subcontractor to enroll in the OCIP and to comply with all OCIP requirements set forth in these contractual provisions, in the OCIP insurance policies, in the Project Insurance Manual, and elsewhere in the contract documents. Contractor/Subcontractor shall provide each of its Subcontractors, among other things, with a copy of the Project Insurance Manual and a copy of these contractual provisions. Contractor/Subcontractor shall require in writing that each enrolling Subcontractor comply with, among other things, the provisions of the OCIP insurance policies, the Project Insurance Manual, and the contract documents. All such requirements shall be included in all subcontracts and sub-subcontracts with eligible parties. The failure of Contractor/Subcontractor or any other party to provide eligible Subcontractors with a copy of this document, the Project Insurance Manual, and/or all other applicable requirements shall not relieve any such Subcontractor of any of the obligations contained therein.

Contractor/Subcontractor shall keep and maintain accurate records and information in accordance with the requirements of the OCIP Insurer(s), the Project Administrator, the Project Insurance Manual, and the contract documents, and shall provide such records and information to Owner, the Program Administrator, and/or the OCIP insurers upon request.

1.6 OCIP DISCLAIMER

The Owner does not warrant or represent that the OCIP coverages constitute an insurance program that completely addresses all the risks of the Contractors/Subcontractors. Prior to the commencement of work under the contract, it is the responsibility of all Contractors/Subcontractors to ensure that the OCIP coverages provided sufficiently address their insurance needs. Any additional insurance coverage purchased will be at Contractor's/Subcontractor's option and sole expense.

1.7 REQUIRED CONTRACTOR/SUBCONTRACTOR PROVIDED INSURANCE COVERAGES

For any work under this contract, and until completion and final acceptance of the work by the Owner, the Contractors/Subcontractors shall, at their own expense, promptly furnish Certificates of Insurance evidencing that coverage is in force and any required Additional Insured Endorsements to the Owner, with a copy to the Program Administrator for the following coverages, before commencing work on the Project.

A. Automobile Liability Insurance Requirements and Limits Are as Follows: See Section 1.8 for Certificate Holder and Additional Insured Endorsement specifications. Automobile Liability Insurance must cover all vehicles owned by, hired by, or used on behalf of the Contractors/Subcontractors for both Project Site and off-site operations with the following minimum limits of liability:

Auto Liability Insurance Limits required:

All Contractors/Subcontractors*

General/Prime Contractor	Subcontractor	
$2,000,000	$1,000,000	Bodily Injury and Property Damage

*See Section 1.8 for additional insured language

B. Workers' Compensation and Employer's Liability Insurance Limits:

Workers' Compensation –Statutory Benefits - All States

Employer's Liability:

$1,000,000 Bodily Injury each Accident
$1,000,000 Bodily Injury by Disease – Policy Limit
$1,000,000 Bodily Injury by Disease – Each Employee

C. General Liability Insurance, minimum limits of liability are as follows:

Eligible Contractors/Subcontractors

General/Prime Contractor	Subcontractor	
$2,000,000	$1,000,000	Bodily Injury and Property Damage
$2,000,000	$1,000,000	Per Occurrence
$2,000,000	$1,000,000	General Aggregate
$2,000,000	$1,000,000	Products/Completed Operations Aggregate
$2,000,000	$1,000,000	Personal/Advertising Injury Aggregate

Ineligible Contractors / Subcontractors (Excluded)

General/Prime Contractor	Subcontractor	
$2,000,000	$1,000,000	Bodily Injury and Property Damage
$2,000,000	$1,000,000	Per Occurrence
$2,000,000	$1,000,000	General Aggregate
$2,000,000	$1,000,000	Products/Completed Operations Aggregate
$2,000,000	$1,000,000	Personal/Advertising Injury Aggregate

D. Professional Liability Insurance: If Contractor's/Subcontractor's work requires design and/or design-assist services, or Contractor/Subcontractor performs professional services of any kind, Contractor/Subcontractor shall purchase and maintain, at its sole cost and expense, Professional Liability (Errors and Omissions) insurance for all professional services provided. This Professional Liability insurance shall include full prior acts coverage sufficient to cover the services under this agreement, with the following minimum limits of liability:

$1,000,000 per Claim/Annual Aggregate

Deductible or self-insured retention amount must not be greater than $100,000 per claim, including coverage of contractual liability.

Professional Liability Insurance is to be maintained during the term of the contract and for so long as the insurance is reasonably available as provided herein, for a period of ten (10) years after completion of the services.

E. Environmental and Asbestos Abatement Coverages: If the Contractor's/Subcontractor's scope of work involves the removal of asbestos, the removal/replacement of underground tanks, or the removal of toxic chemicals and substances, the Contractor/Subcontractor will be required to provide the following minimum limits of liability, for such exposures subject to requirements and approval of the Owner:

$1,000,000 per Claim/Aggregate

F. Aircraft or Watercraft Liability Insurance: If any Contractor/Subcontractor requires the use of Aircraft or Watercraft at the Project Site, the Contractor/Subcontractor shall purchase and maintain, or cause the operator of the Aircraft or Watercraft to purchase and maintain, Aircraft or Watercraft liability insurance. This must insure passengers and the General Public against personal injury, bodily injury or property damage arising out of the ownership, maintenance, use or entrustment to others. It includes Aircraft or Watercraft owned or operated by or rented or loaned to any insured. Use includes operation and "loading or unloading". Contractor/Subcontractor will be required to provide

the following minimum limits of liability, for such exposures subject to requirements and approval of the Owner:

$5,000,000 per Claim/Aggregate

1.8 REQUIRED CONTRACTOR/SUBCONTRACTOR CERTIFICATES OF INSURANCE AND ADDITIONAL INSURED ENDORSEMENTS

Certificates of Insurance and Additional Insured Endorsements acceptable to the Owner and Program Administrator must be filed with the Owner within ten (10) days after award of the contract to all Contractors/Subcontractors and prior to commencement of on-site activities.

All required insurance shall be maintained, without interruption, from the date of commencement of on-site activities, until the date of the final payment or expiration of any extended period, as set forth in this agreement. These certificates and additional insured endorsements required by Section 1.7 and 1.8 shall provide not less than thirty (30) days prior written notice to the Owner, with a copy to the Program Administrator, of any material change in the insurance, cancellation, or non-renewal.

Certificates of Insurance, the Project must be identified on the Certificate of Insurance in the "Description of Operations/Locations/Vehicles/Special Items" section. The Certificates of Insurance should name District, as the Certificate Holder, as specified below:

Certificate Holder:

Compton Community College District
c/o Statewide Educational Wrap Up Program (SEWUP)
2355 Crenshaw Blvd., Suite 200
Torrance, CA 90501

Additional Insured Endorsements: The Owner must be specifically named on the Schedule of an Additional Insured Endorsement, under the section titled, "Name of Person or Organization", as specified below:

1. **Compton Community College District, PCM3, Inc., tBP Architecture, Priest Construction Services, Inc., the State of California, their officers, employees, agents, volunteers and independent contractors as additional insureds.**
2. All Contractors/Subcontractors must provide an additional insured endorsement for automobile liability.

   Ineligible Contractors/Subcontractors must provide an additional insured endorsement on both the Automobile Liability and General Liability policies and a waiver of subrogation on workers' compensation.

   Compton Community College District
   c/o Statewide Educational Wrap Up Program (SEWUP)
   2355 Crenshaw Blvd., Suite 200
   Torrance, CA 90501

1.9 CONTRACTOR/SUBCONTRACTOR INSURANCE FOR PERSONAL PROPERTY AND EQUIPMENT

All Contractors/Subcontractors shall be solely responsible for any loss or damage to their personal property including, without limitation, their tools and equipment, mobile construction equipment, scaffolding, and temporary structures, whether owned, borrowed, used, leased or rented by any Contractor/Subcontractor. Contractors/Subcontractors may at their sole discretion, purchase and maintain insurance or self-insure such equipment and property, and any deductible in relation thereto shall be their sole responsibility. Any insurance, including self-insurance, shall be the Contractors'/Subcontractors' sole source of recovery in the event of a loss.

Any type of insurance or any increase of limits of liability not described in this Section, which the

Contractors/Subcontractors require for their own protection or on account of any statute, will be their own responsibility and at their expense.

1.10 ASSIGNMENT OF RETURN PREMIUMS

The Owner will be responsible for the payment of all premiums associated solely with the OCIP and will be the sole recipient of any dividend(s) and/or return premium(s) generated by the OCIP.

1.11 WAIVER OF SUBROGATION AND OWNER INDEMNIFICATION

With respect to their work on the Project:

1. Owner waives all rights of subrogation and recovery against the Contractors/Subcontractors to the extent of any loss or damage, which is insured under the OCIP.
2. Contractors/Subcontractors waive all rights of subrogation and recovery against the Owner and other Contractors/Subcontractors to the extent of any loss or damage, which is insured under the OCIP.
3. The Contractors/Subcontractors are obligated to indemnify the Owner for damages or claims not covered by the OCIP.

1.12 NO RELEASE

The provision of the OCIP, by the Owner, will in no way be interpreted as relieving the Contractors/Subcontractors of any other responsibility or liability under this agreement or any applicable law, statute, regulation, or order.

1.13 OWNER'S RIGHT TO AUDIT

The Contractor/Subcontractor will permit the Owner and/or its representative to examine and/or audit its books, records and insurance policy information. Contractor/Subcontractor will also provide any additional information to the Owner, or it's appointed representatives, as may be required.

1.14 DUTIES IN THE EVENT OF A LOSS

Contractors/Subcontractors are required to report all losses, which include potential losses, promptly to, OCIP insurers and/or Program Administrator. A full description and details of the incurred loss are also required.

The Contractor/Subcontractor shall assist the Owner, its agents, and the Program Administrator, by providing the utmost cooperation in the adjustment of claims arising out of the operations conducted under, or in connection with, the Project and shall cooperate with the Owner's insurers in claims and demands that arise out of the Work and that the insurers are called upon to adjust.

In the event of an accident, it shall be the responsibility of the employing and/or responsible Contractor/Subcontractor to see that injured workers or members of the public are provided immediate medical treatment. All appropriate medical and claim forms must be filed in accordance with the claim procedures developed for this Project by Keenan & Associates, hereinafter called "Program Administrator." This includes notification to the appropriate state authorities, if necessary.

1.15 OCCUPATIONAL SAFETY AND HEALTH COMPLIANCE

All Contractors/Subcontractors are expected to comply with all applicable local, state, and federal occupational safety and health requirements. If additional safety and health requirements are set forth in the contract specifications, all contractors shall comply with these requirements.

It is the responsibility of each Contractor/Subcontractor to maintain an environment free of recognized hazards. All Contractors/Subcontractors shall exercise reasonable care to prevent work-related injuries; property and equipment damage at the Project, as well as minimize risk to the public and third-party property.

The Program Administrator shall conduct periodic loss control surveys on behalf of the District. These surveys will focus on evaluating the Contractors'/Subcontractors' efforts to minimize loss, assist in identifying loss exposures, and to recommend appropriate corrective measures. The Program Administrator is a resource to supplement the safety and loss prevention activity of Contractors/Subcontractors. Its loss control survey activities or other activities of the Program Administrator and/or OCIP insurers do not in any way relieve the Contractors/Subcontractors of their responsibilities for Project safety.

1.16 PROJECT SAFETY PROGRAM

In addition, local, state, and federal occupational safety and health laws, the following standards apply to all Enrolled and Non-Enrolled Contractors/Subcontractors.

A. Safety Orientation

1. Contractor/Subcontractor employees shall be provided with a project specific safety orientation prior the start of the project. At a minimum, the orientation will address the following items:
    a. The District's site safety requirements.
    b. Site specific safety hazards and protective measures for these hazards.
    c. Emergency telephone numbers and procedures.
    d. Local medical clinic/hospital information within the Medical Provider Network (MPN).

B. Program Management

1. Each Contractor/Subcontractors shall have the following safety programs:
    a. Injury and Illness Prevention Plans
    b. Hazard Communication Programs
    c. Heat Illness Prevention Plans
2. Each Contractor/Subcontractor shall have an onsite competent person responsible for occupational safety and health.

C. Mandatory 6' Fall Protection

1. Contractor/Subcontractor employees shall be protected from fall exposures of 6 feet or greater. Activities include but are not limited to:
    a. Steel erection
    b. Roofing
    c. Framing
    d. Decking
    e. Scaffold work
    f. Work performed from ladders
2. A safety monitor as means of fall protection is prohibited.
3. Ladder jacks and lean-to scaffolds are prohibited.
4. Contractor/Subcontractors are required to provide training to their employees who might be exposed to a fall hazard prior to the exposure or upon hiring. This training shall be documented and available for review.
5. Methods of fall protection include but are not limited to the following:
    a. Railings

b. Covers for Floor, Roof, and Wall Openings
c. Personal Fall Arrest Systems, Personal Fall Restraint Systems, and Positioning Devices
d. Controlled Access Zones

6. The design and construction of railings shall conform to the Cal/OSHA Construction Safety Orders.
7. The minimum parapet height allowed for fall protection is 42 inches or greater.
8. Covers used to cover floor, roof, and wall openings shall be secured in place to prevent accidental removal or displacement and shall be marked in accordance in accordance with Cal/OSHA Construction Safety Orders.
9. Covers used to cover floor and roof openings shall be capable of safely supporting the greater of 400 pounds or twice the weight of the employees, equipment and materials that may be imposed on any one square foot area of the cover at any time.
10. Controlled access zones shall be defined by a control line or other means that restricts access. Each line shall have a minimum breaking strength of 200 pounds. Signs shall be posted to warn unauthorized employees to stay out of the controlled access zone.
11. Control lines shall consist of ropes, wires, tapes, or equivalent materials. Control lines shall be erected and supported in accordance with Cal/OSHA Construction Safety Orders.
12. Scaffold Access/Egress. An internal ladder system with hatches and drop-down ladders or temporary stairs shall be provided for safe access/egress on all scaffolds 20 feet or greater in height. External straight ladders are prohibited on all scaffolds if it exposes a user to a fall of 20 feet or greater in height.

D. Site Safety

1. According to industry practices, it is the responsibility of contractors of all tiers to exercise reasonable care to prevent work-related injuries; property and equipment damage at the project site, as well as minimize risk to the third-party persons and property. Contractors/Subcontractors of all tiers shall be expected to comply with the following safety and loss control requirements:
    1. All Subcontractors shall identify their contact person(s) to the General or Prime Contractor.
    2. All Contractors/Subcontractors shall follow District procedures for dealing with the media.
    3. 100% protective eyewear with side shield protection is required while in the construction environment, shop, or anytime eye hazards exist. Protective eyewear shall bear a legible and permanent “Z87” logo to indicate compliance with applicable ANSI/ASSE Standard.
    4. All construction employees shall wear clothing suitable for the weather and work conditions. At a minimum, this shall be short sleeved shirts, long pants, and leather or other protective work shoes or boots.
    5. Alcohol is prohibited on District property always.
    6. Contractors/Subcontractors will be required to respond to all District complaints about objectionable levels of dust or noise and will be required to provide prompt and appropriate abatement.
    7. Construction personnel cannot enter District grounds other than the construction site unless accompanied by District personnel and are allowed only “incidental” contact with students. Violations of these requirements by any construction employee will result in a mandatory background check of that employee – including fingerprinting – as required by state law.
    8. All prime contractors must attend the site-specific pre-construction meeting.

9. No sexual reference or preference shall be permitted on any piece of clothing or the hardhat. Any employee observed disregarding this policy shall be removed from the job site until further notice.

10. All Contractors/Subcontractors shall control the break time activities of the employees to assure the cleanup of all soda cans, food wrappers, plastic bottles, or food containers from the break area. Such areas shall be cleaned immediately after the break and all waste placed in trash receptacles. No glass containers are permitted on the site.

11. Theft or willful damage to any property of the District, student, or other contractors will be prosecuted fully.

12. All Contractors/Subcontractors will advise non-English speaking employees in their native language either in a written format or via an interpreter of these policies.

E. Crane Safety

1. In accordance with Title 8, California Code of Regulations, section 5006.1, employers shall only permit operators who have a valid certificate (license) of competency to operate cranes. The operator shall have his license on his person, readily available for review.

2. All cranes used in lifting service, exceeding 3 tons rated capacity, and their accessory gear shall not be used until the employer has ascertained that such equipment has been certificated in accordance with Cal/OSHA as evidenced by current and valid documents. Certificates (annual and quadrennial) attesting to current compliance with testing and examination standards shall be maintained, readily available for each crane.

3. The contractor shall provide an erection plan and procedure for erection of trusses and beams over 25 feet long. The erection plan and procedure shall be prepared by a civil engineer currently registered in California. This plan and procedure shall be followed and kept available on the job site.

F. Incident Investigation Requirements

1. The contractor shall perform thorough, in-depth investigations and evaluations of all incidents. A formal incident investigation shall be conducted whenever any incident occurs, including, without limitation, both non-injury incidents and incidents involving first aid. Additionally, near miss accidents and/or incidents must be reported and undergo the same in-depth investigation, root cause analysis and lessons learned process.
2. Recommendations and lessons learned to prevent recurrence of incidents shall be documented and communicated to all employees of contractor and subcontractors through safety meetings and on-the-job training.

G. Return to Work:

1. The District and OCIP Carrier are committed to working with all Enrolled Contractors and Subcontractors to promote the successful & timely return to work of injured employees following a work-related injury. The purpose of this policy is to ensure that Enrolled Contractor/Subcontractor employees who temporarily cannot return to their normal duties due to job-related injury or illness but can safely perform transitional duties while recovering is offered appropriate transitional duties for a limited time only.
    a. An employee who has experienced a job-related injury requiring medical treatment must provide a proper medical release prior to returning to work.
    b. An employee who has been removed from the jobsite ambulatory must provide a proper medical release prior to returning to work.
    c. Each Enrolled Contractor/Subcontractor will cooperate with the OCIP Carrier to facilitate the return to work of any injured employee capable of safely performing transitional duties.

d. When the employee is released to transitional duties, it is the Enrolled Contractor/Subcontractor's responsibility to facilitate the injured employee's return to work.
e. The Enrolled Contractor/Subcontractor is expected to accommodate the injured employee and facilitate the return to work.
f. It will be the responsibility of the Insurance Carrier's Adjuster to maintain communication with the treating physician and the Enrolled Contractor/Subcontractor to facilitate the prompt return of an employee to full work status.

G. Competing Safety Requirements:

The District and SEWUP OCIP program place a very high value on project safety. Each may have their own safety requirements that are very similar in nature. However, in the event the requirements are in conflict or one is silent on a particular matter, then the requirement affording the greatest of amount protection will control. For example, if the District's Safety Program Requirements do not mandate 6' Fall Protection, then Section "6.5 Mandatory 6' Fall Protection" contained in the SEWUP Project Insurance Manual will control.

H. Noncompliance and Unsafe Practices

Owner or their representative shall have the authority to immediately cease any and all operation (s) on the jobsite that is deemed by Owner or their representative to be unsafe to property or has the potential to cause Bodily Injury, pursuant to Title VIII California Code of Regulation, Section 1511. Any such cession of work shall not constitute recoverable delay or other contractual remedies for liquidated damages and may expose the offending contractor to any such losses to the District or other trades.

1.17 OWNER'S INSURANCE OBLIGATIONS; CONTRACTORS'/SUBCONTRACTORS' OBLIGATIONS; REPRESENTATIONS, WARRANTIES AND DISCLAIMERS

(a) Owner assumes no obligation to provide insurance other than that summarily described in these Contractual Provisions, in the Project Insurance Manual, and in the OCIP insurance policies. Contractor/Subcontractor shall review the OCIP coverages, limits of liability, and insurance policies to satisfy themselves that the coverages offered thereby meet its needs. Nothing contained herein shall be deemed to place any responsibility on Owner, and Owner disclaims any responsibility, for ensuring that the insurance provided by the OCIP is sufficient for the conduct of Contractor's/Subcontractor's business or performance of the Work, including, without limitation, the adequacy of the limits of liability provided by, and as to all other terms, conditions and exclusions of, the OCIP insurance policies. The furnishing of insurance by Owner through the OCIP shall in no way relieve or limit or be construed to relieve or limit Contractor/Subcontractor of any responsibility, liability or obligation imposed by the contract, the contract documents, the Project Insurance Manual, the OCIP insurance policies, or by law, including, without limitation, all indemnification obligations on the part of Contractor/Subcontractor.

(b) By enrolling in the OCIP, Contractor/Subcontractor acknowledge that (i) the limits of liability of the OCIP insurance policies are shared by all insured parties under the OCIP; (ii) Owner is not an insurer or in the business of insurance and is not an agent, broker, partner or guarantor of Contractor/Subcontractor or any of the insurance companies providing coverage under the OCIP (the "OCIP insurers"); and (iii) Owner is not responsible for (a) the availability, adequacy, or exhaustion of the limits of the OCIP, (b) the present or future solvency of any of the OCIP insurers or (c) any claims or disputes by, between or among Owner, Contractor/Subcontractor and any of the OCIP insurers, including, without limitation, claims or disputes arising out of any the OCIP insurers' payment or nonpayment of claims or losses, or such insurers' contractual or extra-contractual duties, including, without limitation, defense and/or indemnity obligations. Any type of insurance coverage or limits of liability not provided by the OCIP which Contractor/Subcontractor desires

for its own protection, or which is required by applicable laws or regulations, shall be its sole responsibility and expense and shall not be included in its compensation for the Work. If Contractor/Subcontractor believes that additional limits of liability beyond those provided by the OCIP would be prudent for its protection, it agrees to investigate and procure such additional limits of liability for itself at its sole cost.

(c) By enrolling in the OCIP, Contractor/Subcontractor represents and warrants that it has had the opportunity to read and analyze (and to obtain professional assistance to read and analyze) a copy of the OCIP insurance policies and understand the contents thereof. Any reference in these contractual provisions, in the Project Insurance Manual, or elsewhere in any contract document as to amount, nature, type or extent of coverage provided under the OCIP and/or potential applicability to any potential claim or loss is for reference only and Contractor/Subcontractor represents and warrants that it has not relied upon any such reference or any other oral or written statement by or on behalf of Owner, the Project Administrator, or any of its or their agents, employees or representatives, but solely upon its own independent review and analysis of the OCIP insurance policies in formulating any understanding and/or belief as to amount, nature, type or extent of any coverage, conditions, extensions, or limits of liability provided by and as to all other terms of the OCIP insurance policies and/or their potential applicability to any claim or loss or their sufficiency for the conduct of Contractor's/Subcontractor's business or performance under the contract documents. To the extent that Contractor/Subcontractor deems it prudent to secure and maintain additional, supplemental, excess, or wholly independent insurance or liability associated with its Work on the Project or otherwise, it shall be responsible to do so at its sole expense.

(d) Contractor/Subcontractor hereby releases Owner, the Program Administrator and their respective representatives, agents, directors, officers, employees, partners, shareholders, members, affiliates of every tier, successors, and assigns from any and all claims and liabilities arising out of or relating to acts, errors, omissions or negligence (i) in the design, selection, placement, adequacy, amount, limits, scope and nature of insurance coverage afforded by the OCIP, (ii) in the selection, performance and present and future solvency of the OCIP insurers, and (iii) in the implementation and administration of the OCIP. Contractor/Subcontractor shall make its own determinations regarding such matters and expressly waives all rights and benefits conferred upon it by the provisions of California Civil Code Section 1542, which provides:

"A general release does not extend to claims which the creditor did not know or suspect to exist in his or her favor at the time of executing the release, which if known by him or her must have materially affected his or her settlement with the debtor."

2. Contractor/Subcontractor expressly acknowledges that the foregoing waiver of the provisions of Section 1542 was separately bargained for, and expressly agrees that the release provision shall be given full force and effect, including, without limitation, as to unknown or unsuspected claims, demands, liabilities and causes of action, if any may exist or arise. This release provision shall survive the completion of the Work and the expiration or other termination of the Agreement.

1.18 JOINT DEFENSE OF CLAIMS AND SUITS AGAINST MORE THAN ONE INSURED

(a) If a claim, demand, suit, or other proceeding ("Claim") is brought against more than one insured under the OCIP, Owner and Contractor/Subcontractor recognize the common interest of all OCIP insureds in jointly defending that Claim. To the fullest extent permitted by law, and absent a material, current, actual, unwaivable conflict of interest mandating the appointment of separate counsel under applicable law, Owner and Contractor/Subcontractor insured under the OCIP (i) shall be defended by the same counsel and by the same consultants and experts selected by Owner and/or the OCIP insurers at its or their sole discretion, regardless of whether the defense under the OCIP is provided subject to a reservation of rights issued by any OCIP insurer, and (ii) waive their respective rights to independent counsel as to any and all such Claims. This

waiver is deemed to be continuing. Contractor/Subcontractor agrees to execute such other documents as are required to effectuate this waiver and fulfill the purpose of this Section 1.18.

(b) In defense of Claims arising under the OCIP, information shared with counsel engaged to defend the insureds (" Defense Counsel") will be protected from disclosure and shall remain privileged even after the termination of the OCIP and/or the completion of the Project. Contractor/Subcontractor agrees not to disclose to any person or entity, other than to Owner and to Defense Counsel, any confidential information obtained in the defense or pursuit of Claims covered, or potentially covered, under the OCIP. Any such confidential information shall only be used in matters that arise directly pursuant to such OCIP Claims. However, disclosures of such confidential information may be made (i) upon written approval from Defense Counsel or (ii) where required by court order or by applicable law.

(c) Nothing in this Section 1.18 shall preclude Contractor/Subcontractors from engaging counsel of its choice, at its sole expense, to associate in the defense of any such Claim.

1.19 Duty of Care

3. Nothing contained in the OCIP insurance policies, the contract, these contractual provisions, any other contract document, or the Project Insurance Manual shall relieve Contractor/Subcontractor of its obligations to exercise due care in the performance of its duties in connection with the Work and to complete the Work in strict compliance with the contract documents.

NOTE: THE OWNER AND PROGRAM ADMINISTRATOR MUST APPROVE CHANGES TO ANY OCIP REQUIREMENT OR PROCEDURE. NO CONTRACTOR OR SUBCONTRACTOR HAS THE AUTHORITY TO AMEND THE OCIP REQUIREMENTS.

OCIP EXHIBIT A

PROTECTIVE SAFEGUARDS

APPLICABLE TO 'WOOD FRAME' PROJECTS ONLY:

The Builders Risk Policy will not pay for LOSS caused by or resulting from exposures, if the applicable protective safeguards are not maintained during the Builders Risk Policy term of INSURED PROJECT.

As a condition precedent to fire, theft, vandalism, and malicious mischief coverage provided by the Builders Risk Policy, the following protective safeguards will be maintained at every INSURED PROJECT **site of Wood Frame construction insured by the Builders Risk Policy.**.

1. **Fencing - The entire** INSURED PROJECT site shall be surrounded with a six foot chain link fence suitably anchored in the ground and placed a reasonable distance from the insured property. Gates through the chain link fence shall be securely locked during non-working hours.
2. **Lighting - The entire** INSURED PROJECT site shall be illuminated from sunset to sunrise, each day.

www.sewup.org

Statewide Educational Wrap Up Program (SEWUP) JPA

Owner Controlled Insurance Program (OCIP)

Project Insurance Manual

This manual is intended to provide only a general overview of the Owner Controlled Insurance Program and does not in any way alter or take precedence over the language in the actual insurance policies and contracts. It makes no promise to provide insurance to those not enrolled in the Owner Controlled Insurance Program

Program Administrator:

2355 Crenshaw Blvd., Suite 200
Torrance, CA 90501
Phone: 800.654.8102
SEWUP Department
Fax: 310.787.8838
License # 0451271

Table of Contents

Preface

About This Manual

- Identifies responsibilities of the various parties involved in the project
- Provides a basic description of the OCIP coverage and program structure
- Describes audit and administrative procedures
- Provides answers to basic questions about the OCIP
- Claim reporting procedures
- Will be updated as necessary

This Manual Does Not

- Provide OCIP coverage interpretations
- Provide complete information about OCIP coverages (Refer to OCIP policies)
- Provide answers to specific claims questions

1.0 Introduction

The Statewide Educational Wrap Up Program JPA (SEWUP), of which this school district is a member, is providing an Owner Controlled Insurance Program (OCIP) for work performed at specific project sites, on behalf of the district, who is the "Owner". The OCIP is an insurance program that insures eligible and enrolled subcontractors, for Work performed at the Job Site.

Certain subcontractors are excluded from this OCIP. These parties are identified in the Contract Documents and Section 3 (Definitions) of this manual.

The Owner / District will pay the insurance premiums for the OCIP coverage described in this manual. You should notify your insurer(s) to endorse your coverage to be excess and contingent over the insurance provided under this OCIP for on-site activities and the related costs. Each bidder, the Contractor and its subcontractors, are required to exclude from its bid price and requests for payment, the cost of insurance coverages that will be provided by the OCIP.

Note
The guidelines in this manual are to be used for informational purposes only. This manual does not constitute a contractual agreement. If conflicts exist between this manual and OCIP Insurance Policies, or this manual and the Contract between the District, Construction Manager, and Contractor (Enrolled Parties), OCIP Policies or Owner's Contract will govern.

Any questions regarding a Subcontractor's status as "Eligible" or "Ineligible" should be referred by written request to Contractor and Owner and approved by the Program Administrator.

1.1 Participation & Contractor Compliance

Participation in the OCIP is mandatory but not automatic. Enrollment eligibility will be determined upon completion of and online enrollment form which will include documentation of trade, scope of work, estimated value, estimated start and completion. All Contractors and subcontractors of all tiers must register via Wrap Portal (www.keenanwrap.com) and adhere to all program requirements, as specified in Section 5.0.

The program Administrator will provide access to an online enrollment via Keenan Wrap, through its proprietary software referred to herein as Wrap Portal; a User Name, Password and URL for website enrollment will be provided to each subcontractor upon entry of Subcontractor identifying information into Wrap Portal by Contractor or Parent Subcontractor.

Enrollment (Definition): An Eligible Subcontractor is considered Enrolled once all required documents are received, reviewed and processed by the OCIP Program Administrator and Insurer.

1.2 Subcontractor Eligibility

A. Eligible

Includes all Subcontractors providing direct labor on the Project and excludes Ineligible contractors as defined below. Temporary labor services and leasing companies are to be treated as Eligible Contractors.

B. Ineligible Contractor (Excluded)

It is not the intent to insure (but is not limited to) consultants, suppliers, abatement and/or removal of hazardous materials, vendors, materials dealers, surveyors, guard services, non-construction janitorial services, and truckers, including trucking to the Project where delivery is the only scope of work performed. **Ineligible/excluded parties are required to ensure that any eligible subcontractors, who are hired for installation or to provide on-site labor, comply with the OCIP Enrollment and are provided with a copy of this OCIP Project Manual**. Ineligible contractors will be required to adhere to insurance certificate requirements as stated in section 4.0, under Contractor-Provided Insurance Coverage. In addition, any party deemed an Ineligible Contractor, but who has direct labor on the Project, will be required to participate in the Project Safety Program (see Section 6.0).

1.3 Project Site and Offsite Premises

Coverages provided by the OCIP are Project Site specific. The Project-Site must be designated by the Owner. The Project Site consists of any and all projects that are endorsed to this policy, which includes the:

- Ways and means adjoining the endorsed project site.
- Adjacent locations to the endorsed projects sites where incidental operations are being performed, excluding permanent locations.

With the exception of 1 and 2 mentioned above, off-site locations, labor and operations are not covered by the OCIP. It will be the responsibility of each contractor to maintain off-site insurance, as identified in Section 4.3, which specifies coverage types and minimum limits. Contractor will promptly furnish to the Owner, or their designated representative, Certificates of Insurance evidencing that all required insurance is in force.

2.0 Information Directory

2.1 Program Administrator

Keenan & Associates - SEWUP Department
2355 Crenshaw Blvd., Suite 200
Torrance, CA 90501
Phone: 800.654.8102
Fax: 310.787.8838

Questions Regarding OCIP
Refer questions concerning the OCIP and its administration or coverage's to the Program Administrator. Answers to questions may also be found in Section 9.0 - Frequency Asked Questions.

2.2 Insurance Companies

Workers' Compensation	Liberty Mutual Insurance
General Liability	Lloyds of London
Excess Liability	Lloyds of London
	AXIS
	Colony Insurance Company
	Ironshore

	Endurance American Specialty Insurance Company
Builder's Risk	Ace American Insurance Company
Contractor's Pollution Liability	Berkeley Assurance Insurance Company

See Section 6 For Claims Reporting Instructions and Procedures.

3.0 OCIP Coverages

Description of Owner Controlled Insurance Program (OCIP) Coverages

The OCIP is for the benefit of the Owner and all Enrolled Contractor/Subcontractors who have on-site employees. OCIP coverage applies only to Work performed under the contract at the Project Site specified by the Owner. All Contractors must provide their own insurance for Automobile Liability and off-site locations, labor, and operations. The following coverages are provided by the OCIP:

Workers' Compensation and Employers Liability

Commercial General & Excess Liability

Builder's Risk

Contractor's Pollution Liability

A Certificate of Insurance evidencing workers' compensation & employer's liability, general and excess liability and pollution liability insurance will be issued to each Enrolled Party via Wrap Portal. Other documentation including forms, posting notices, etc., will be provided to each Enrolled Party.

OCIP Disclaimer
The OCIP is intended to provide broad coverages and high limits, to all Enrolled Contractors/Subcontractors. The Owner does not warrant or represent that the OCIP coverages constitute an insurance program that completely addresses the risks of the Contractors/Subcontractors. Prior to contract award, it is the responsibility of all Contractors/Subcontractors to ensure that the OCIP coverages provided sufficiently address their insurance needs. Upon request, OCIP policies are available for review.

3.1 Workers' Compensation and Employer's Liability Insurance

Workers' Compensation and Employer's Liability Insurance, will be provided in accordance with applicable state laws, to all Enrolled Contractors/Subcontractors, each as named insured, and issued an individual policy reflecting the following Limits of Liability:

Coverage A – Workers' Compensation

Liability imposed by the Workers' Compensation and/or Occupational Disease statute of the State of California or governmental authority having jurisdiction related to the work performed on the Project.

Coverage B – Employers Liability

$1,000,000 Bodily Injury each Accident
$1,000,000 Bodily Injury by Disease – Policy Limit
$1,000,000 Bodily Injury by Disease – Each Employee

Contractor Deductible: None

Exclusions: The known exclusions for this coverage are listed in Section 10.0 – Known Policy Exclusions. This is a summary and may not be exhaustive. The policy language may contain additional exclusionary language, limitations or carve-backs that may not be identified in the list. It is the

responsibility of the Contractor/Subcontractor to review the policy for the complete details of all exclusions.

Policy Term: The master policy effective date is October 1, 2019. The policy term is three years, with automatic one-year renewals until the Project is completed. The policy is intended to remain in effect for duration of the contractor's contractual work. Warranty work and post contract repair work is excluded. The policy is intended to remain in effect for the length of the Project or the policy end date, whichever comes first.

3.2 Commercial General Liability & Excess Liability Insurance

All Enrolled Contractors/Subcontractors are considered Named Insured under SEWUP's Master General & Excess Liability policies. The Master Policies are available for review by Contractors/Subcontractors, upon request to the Owner or the Program Administrator.

Primary Coverage: **Total Limits for Bodily Injury and Property Damage**

$125,000,000 Each Occurrence
$185,000,000 General Annual Aggregate – per Policy
$125,000,000 Products and Completed Operations Aggregate

- Ten (10) year Products and Completed Operations Extension after Notice of Completion is filed by the Owner, or date Occupancy is taken with a single non-reinstated aggregate limit.

Policy Forms: **"Occurrence" Form**

Contractor Deductible: None

Exclusions: This insurance does not provide coverage for products liability of any enrolled party for any product manufactured, assembled or otherwise worked upon away from the Project Site.

The known exclusions for this coverage are listed in Section 10.0 – Known Policy Exclusions. This is a summary and may not be exhaustive. The policy language may contain additional exclusionary language, limitations or carve-backs that may not be identified in the list. It is the responsibility of the Contractor/Subcontractor to review the policy for the complete details of all exclusions.

Policy Term: The master policy effective date is October 1, 2019. The policy is intended to remain in effect for the length of the Project or through October 1, 2024 at 12:01am, whichever comes first.

3.3 Builder's Risk Insurance

The Builders Risk Master Policy names the Owner as named insured and enrolled Contractors/Subcontractors as additional insured's. This Master policy is available for review by Contractors/Subcontractors, upon request to the Owner or the Program Administrator.

Primary Coverage: Builders Risk coverage will be in place during the Course of Construction at the Project. Such insurance shall be written on a repair or replacement cost basis, subject to exclusions, sub limits, property limitations and conditions. The policy covers materials, supplies, equipment, fixtures, or machinery, which will become a permanent part of the building, or structure at the Project site specified, limited to policy form, policy limit, and exclusions.

Deductible: A deductible, which shall be determined by the type of construction, will apply to each occurrence. The deductible schedule is as follows:

New Construction & Renovation

- $10,000 - $50,000 deductible (depending on type of structure) for Wood Frame, Masonry Non-Combustible or Joisted Masonry, and Fire Resistive / Non-Combustible.
- $50,000 deductible for Water Damage to structural renovations.
- $100,000 deductible for Water damage to Large Span Buildings, (with unsupported roof greater than 200 feet); and Stadiums/Arenas (open air, fixed roof, and/or retractable roof).

Contractor Deductible: Contractor/Subcontractors shall be responsible for the applicable deductible. The deductible shall apply to each occurrence and must be satisfied prior to payment of the loss. The deductible shall not be reimbursed by the OCIP Insurance Program or the District.

Exclusions: The known exclusions for this coverage are listed in Section 10.0 – Known Policy Exclusions. This is a summary and may not be exhaustive. The policy language may contain additional exclusionary language, limitations or carve-backs that may not be identified in the list. It is the responsibility of the Contractor/Subcontractor to review the policy for the complete details of all exclusions.

Policy Term: The policy term is the term of the project.

Note:
All Contractors'/Subcontractors' shall be responsible for any loss or damage to their personal property. This would include, but is not limited to, tools, equipment, mobile construction equipment, or materials NOT intended to be a permanent part of the building, whether owned, borrowed, used, leased, or rented by any Contractor/Subcontractor. Any insurance purchased by the Contractors/Subcontractors, or self-insurance, shall be the Contractors'/Subcontractors' sole source of recovery in the event of a loss.

3.4 Contractor's Pollution Liability Insurance

Contractor's Pollution Liability, is written on an "Occurrence" form under a master liability policy. This Master policy is available for review by Contractors/Subcontractors, upon request to the Owner or the Program Administrator. Certificates of Insurance will be provided to all enrolled Contractors/Subcontractors, as named insured.

Primary Coverage: Bodily Injury or Property Damage from a pollution event as defined within the policy form resulting from covered operations or completed operations.

Limits:

$15,000,000 Per Occurrence /$25,000,000 Policy Aggregate

Defense costs included within limits up to $1M

Deductible: $10,000 Per Occurrence

Contractor/Subcontractor shall be liable, at its expense; to the extent claims payable are attributable to their acts or omissions and/or the acts or omissions of its Subcontractors of any tier or any other entity or person for whom it may be responsible. The deductible amount shall not be reimbursed by the OCIP Insurance Program or the District.

Exclusions: The known exclusions for this coverage are listed in Section 10.0 – Known Policy Exclusions. This is a summary and may not be exhaustive. The policy language may contain additional exclusionary language, limitations or carve-backs that may not be identified in the list. It is the

responsibility of the Contractor/Subcontractor to review the policy for the complete details of all exclusions.

Policy Term: The master policy effective date is October 1, 2019. The policy is intended to remain in effect for the length of the Project or through October 1, 2024 at 12:01am, whichever comes first.

3.5 OCIP Certificates

All Enrolled Contractors/Subcontractors will receive their own Workers' Compensation policy. Certificates of Insurance will be furnished for the General Liability, Excess Liability, Contractor's Pollution Liability, and Builder's Risk coverages. These policies are available for review by the Contractor/Subcontractor, upon request to the Owner or the Program Administrator. Such policies or programs may be amended from time to time and the terms of such policies or programs are incorporated herein by reference. Contractors/Subcontractors hereby agree to be bound by the terms of coverage, as contained in such insurance policies and/or self-insurance programs.

4.0 Contractor Required Insurance

For any work under this contract, and until completion and final acceptance of the work by the Owner, the Contractors/Subcontractors shall, at their own expense, promptly furnish Certificates of Insurance and an Additional Insured Endorsement acceptable to the Owner and Program Administrator. Copies should be provided to the Program Administrator via Wrap Portal, for both Project Site and Off-Site operations, within ten (10) days after award of the contract to all Contractors/Subcontractors and prior to commencement of on-site activities.

All required insurance shall be maintained, without interruption, from the date of commencement of on-site activities, until the date of the final payment or expiration of any extended period. Certificates and additional insured endorsements shall provide not less than thirty (30) days prior written notice to the Program Administrator, of any material change in the insurance, cancellation or non- renewal.

The OCIP places contractors and subcontractors into one of two main categories: Enrolled Contractors or Ineligible (Excluded) Contractors.

4.1 Verification of Required Insurance Coverages

A. Enrolled Contractor/Subcontractors:

- **Certificates of Insurance** must be provided, evidencing Workers' Compensation & Employer's Liability, and General Liability, Excess/Umbrella Liability insurance for off-site activities, and Automobile Liability insurance for on and off-site activities as per the insurance specifications in the Contract.

- **Additional Insured Endorsements** for Auto Liability. These endorsements must name **the District** specifically as additional insured. If the insured's policy has a 'Blanket' Additional Insured Endorsement and cannot name any entity, provide a copy of the endorsement for our review.

B. Ineligible (Excluded) Contractors/Subcontractors:

- **Certificates of Insurance** must be provided, evidencing Workers' Compensation & Employer's Liability, General Liability, Excess/Umbrella Liability and Automobile Liability insurance for all activities including both on-site and off-site activities as per the insurance specifications in the Contract.

- **Additional Insured Endorsements** for General Liability and Auto Liability. These endorsements must name **the District** specifically as additional insured. If the insured's

policy has a 'Blanket' Additional Insured Endorsement and cannot name any entity, provide a copy of the endorsement for our review.

- **Waiver of Subrogation** for Workers Compensation in favor of the owner.

4.2 Contractor Maintained Insurance Coverage

***Indicates off-site required coverage / **Indicates off-site & on-site required coverage**

A. Workers' Compensation and Employer's Liability Insurance*

- Enrolled & Ineligible/Excluded Contractors
- Required limits on Certificate of insurance are as follows:

Subcontractors	
Part 1: Workers Compensation	California Statutory Benefits
Part 2: Employer's Liability	
$1,000,000	Bodily Injury each Accident
$1,000,000	Bodily Injury by Disease – Policy Limit
$1,000,000	Bodily Injury by Disease – Each Employee

- Ineligible/Excluded Subcontractors must also provide **Waiver of Subrogation** for Workers Compensation in favor of the owner.

B. General Liability Insurance*

- Enrolled & Ineligible/Excluded Subcontractors
- Minimum Required limits of insurance are as follows:

General/Prime Contractor	Subcontractor	
$2,000,000	$1,000,000	Bodily Injury and Property Damage
$2,000,000	$1,000,000	Per Occurrence
$2,000,000	$1,000,000	General Aggregate
$2,000,000	$1,000,000	Products/Completed Operations Aggregate
$2,000,000	$1,000,000	Personal/Adv. Injury Aggregate

- It is recommended that the Designated Operations Covered by a Consolidated (Wrap-Up) Insurance Program (CG 21 31 05 09) endorsement be added to your primary general liability policy. This will ensure appropriate coverage for any off-site exposures associated with this OCIP project.

C. Automobile Liability Insurance**

- Enrolled & Ineligible/Excluded Subcontractors
- Must cover all vehicles owned by, hired by, or used on behalf of the Contractors/Subcontractors for both Project Site and off-site operations with the following minimum limits of liability:

General/Prime Contractor	Subcontractor	
$2,000,000	$1,000,000	Bodily Injury and Property Damage

D. Professional Liability Insurance**

- Enrolled & Ineligible/Excluded Subcontractors
- If Subcontractor's work requires design and/or design-assist services, or Subcontractor performs professional services of any kind, Subcontractor shall purchase and maintain, at its sole cost and expense, Professional Liability (Errors and Omissions) insurance for all professional services provided.
- Shall include full prior acts coverage sufficient to cover the services under this agreement, with the following minimum limits of liability:
  $2,000,000 per Claim/Annual Aggregate
- Deductible or self-insured retention amount must not be greater than $100,000 per claim, including coverage of contractual liability.
- Must be maintained during the term of the contract and for so long as the insurance is reasonably available as provided herein, for a period of ten (10) years after completion of the services.

E. Environmental and Asbestos Abatement Coverages**

- Ineligible Subcontractors
- If Subcontractor's scope of work involves the removal of asbestos, the removal/replacement of underground tanks, or the removal of toxic chemicals and substances, the Contractor/Subcontractor will be required to provide the following minimum limits of liability, for such exposures subject to requirements and approval of the Owner:

  $2,000,000 per Claim/Aggregate

F. Aircraft or Watercraft Liability Insurance**

- If any Subcontractor requires the use of Aircraft or Watercraft at the Project Site, the Subcontractor shall purchase and maintain, or cause the operator of the Aircraft or Watercraft to purchase and maintain, Aircraft or Watercraft liability insurance.
- Must insure passengers and the General Public against personal injury, bodily injury or property damage arising out of the ownership, maintenance, use or entrustment to others.
- Includes Aircraft or Watercraft owned or operated by or rented or loaned to any insured.
- Use includes operation and "loading or unloading". Contractor/Subcontractor will be required to provide the following minimum limits of liability, for such exposures subject to requirements and approval of the Owner:

  $5,000,000 per Claim/Aggregate

4.3 Certificates of Insurance

The Project must be identified on the Certificate of Insurance in the "Description of Operations/Locations/Vehicles/Special Items" section. The Certificates of Insurance should name District, as the Certificate Holder, as specified below:

Certificate Holder:

Compton Community College District
c/o Statewide Educational Wrap Up Program (SEWUP)
2355 Crenshaw Blvd., Suite 200
Torrance, CA 90501

4.4 Additional Insured Endorsements

The Owner must be specifically named on the Schedule of an Additional Insured Endorsement, under the section titled, "Name of Person or Organization", as specified below:

- **Compton Community College District, PCM3, Inc., tBP Architects, Priest Construction Services, Inc., the State of California, their officers, employees, agents, volunteers and independent contractors as additional insureds.**
- All Contractors must provide an additional insured endorsement for automobile liability.
- Ineligible/Excluded Contractors must provide an additional insured endorsement on both the Automobile Liability and General Liability policies and a waiver of subrogation on workers' compensation.

Compton Community College District
c/o Statewide Educational Wrap Up Program (SEWUP)
2355 Crenshaw Blvd., Suite 200
Torrance, CA 90501

5.0 Contractor Responsibilities / Requirements

Throughout the course of the Project, Subcontractors will be responsible for reporting and maintaining certain records as outlined in this section.

All Subcontractors shall cooperate with, and require their tier Subcontractors to cooperate with, the Owner and the Program Administrator, regarding administration and operation of the OCIP. **Each Subcontractor must include this document with their bid specifications to all Subcontractors**.

Responsibilities of Subcontractors:

- Enrolling in the OCIP and assuring all eligible tier subcontractors promptly enroll in the OCIP, via Wrap Portal, prior to the start of any work
- Complying with the provisions of the OCIP Manual and cooperating in the administration and operation of the OCIP
- Including OCIP Provisions in all subcontracts, as appropriate
- Identifying and removing from bid the cost of OCIP-provided insurance (by all eligible contractors / subcontractors)
- Providing each Subcontractor with a copy of the OCIP manual
- Providing timely evidence of insurance to the SEWUP Department via Wrap Portal
- Notifying the SEWUP Department of all awarded subcontracts via Wrap Portal
- Maintaining and reporting monthly payroll records (by all eligible subcontractors) via Wrap Portal
- Complying with the OCIP Administrator's requests for information

- Complying with insurance, claim and safety procedures
- Notifying OCIP Administrator immediately of any insurance cancellation or non-renewal of Contractor required insurance
- Complying with the OCIP insurance policy requirements, including but not limited to, physical audit of payroll records by the insurance company or its representatives.

5.1 Contractor Bids & Change Orders - Removing Insurance Costs

The Owner / School District provides insurance for all eligible, Enrolled Contractors/Subcontractors for work performed at the project site(s). The Owner pay's the insurance premiums for the OCIP coverages described in this manual.

Contractors/Subcontractors who are eligible for enrollment in the OCIP are required to **exclude the cost of insurance that is provided by the OCIP, from its bid price** for the proposed scope of work at the project site(s).

Change orders should be priced by the Contractor / Subcontractor to exclude any costs of insurance for coverage's that are provided by the OCIP. It is the responsibility of the contractor to ensure that their subcontractors of all tiers also exclude the cost of insurance

5.2 Program Compliance

A. Participation in the OCIP is mandatory but not automatic. An Eligible contractor is not enrolled until the Program Administrator receives and approves the following items:

- Completed Contract Enrollment, for each awarded contract, within ten (10) days of Contract Award and prior to commencement of On-site activities. Enrollments can be completed and submitted electronically visiting www.keenanwrap.com
- Certificates of Insurance, evidencing Insurance for Workers' Compensation & General Liability coverages for **Off-Site** locations, labor, and operations
- Certificate of Insurance, including an Additional Insured Endorsement, naming the Owner as an Additional Named Insured, for Automobile Liability for both Project Site and Off-Site operations
- Policy Declarations pages, including proof of rates from your current policies

B. All Contractors/Subcontractors further acknowledge and agree to comply fully and promptly with such safety, loss control, and quality control rules, requirements, and directives as may from time to time be promulgated by Owner, the Program Administrator and/or the OCIP insurers or any of its or their respective consultants, agents, or representatives. Nothing in this document or any other contract document or in the Project Insurance Manual, shall be deemed to render Owner or any of its affiliates of any tier an employer of Contractor/Subcontractor or any of its Subcontractors or any of its or their personnel or employees. **Failure to comply will be considered non-performance under the contract.**

OCIP Enrollment completed through Wrap Portal by the following deadline:

- Subcontractors (All Tiers): Within ten (10) days of Contract Award and prior to commencement of On-site activities

All questions regarding enrollment compliance should be directed to the assigned OCIP Administrator.

Any Subcontractor who enrolls in the OCIP after their start date will have to provide a No-Known-Loss Letter to the Program Administrator, along with enrollment documentation.

For any work under this contract, and until completion and final acceptance of the work by the Owner, the Subcontractors shall, at their own expense, promptly furnish Certificates of Insurance to the Program Administrator before commencing work on the Project Site. Automobile Liability Insurance must be maintained for both Project Site and off-site operations.

5.3 Confirmation of Enrollment & Evidence of OCIP Coverages

Upon review of completed enrollment, OCIP Administrator will acknowledge acceptance of the Eligible Subcontractor into the Owner's OCIP, by issuing the following to each Enrolled Party:

- Confirmation Letter
- OCIP Certificates of Insurance
- Claims Kit, including DWC1 and MPN Notices

These documents, as issued by the OCIP Administrator, will clearly identify the effective dates of the OCIP coverages for the Contract. A separate Workers' Compensation policy will be issued and sent to each Enrolled Party.

Should an Enrolled Party perform work on several contracts/projects, an Enrollment Form must be completed for each contract. The OCIP Administrator will issue confirmation letters and certificates of insurance to each Enrolled Party for each separate contract. However, only one individual Workers' Compensation policy (that will apply to all contracts/projects) will be issued to each Enrolled Party.

Note:
Verify that the Workers' Compensation effective date, listed on your OCIP Certificate of Insurance, reflect the same date as your start date.

5.4 Payroll Reporting Compliance

Project Site Monthly Payroll Report Requirements

- Project Site Monthly Payroll must be submitted to the Program Administrator by the 10th of each month via Wrap Portal until the completion of the contract and in no event shall be later than the 15th of each month. Payroll shall be reported only for labor performed at the project jobsite.
- Monthly Payroll Reporting is to begin from the enrollment effective date until the completion of the contract or the policy end date.
- Should no work be performed on the Project Site during a given month, each Enrolled Party is required to submit a form stating that "Non-Performance."
- Payroll reporting must summarize the unburdened payroll by Workers' Compensation Class Code. Certified payroll is not a requirement of the OCIP and cannot be accepted.
- If Monthly Payroll Report is not submitted to Program Administrator monthly, the Construction Manager and/or Owner may withhold payment until the report is received.

- For those Enrolled Parties performing Work under multiple contracts, for each contract, a Monthly Payroll Report is required each month until contract is finalized.
- All reported project site monthly payroll reported from October through the end of September is submitted by Program Administrator to the OCIP Insurance Carrier for auditing.
- Subcontractor shall to keep and maintain accurate and classified records of their payroll for operations at the Project Site.
- A carrier audit may be performed using the reported payroll and other supporting documents. Contractor / Subcontractor agrees to cooperate with the OCIP insurance carrier(s) or their 3 party auditors by responding to and providing documents as requested in a timely manner.

Workers' Compensation Insurance Rating Bureau Requirements

- **Payroll Reporting for Each Workers' Compensation Policy Issued -** Once an Eligible Contractor/Subcontractor is enrolled into the OCIP, the Program Administrator will issue a separate Workers' Compensation Policy. All Enrolled Subcontractors will need to comply with the rules and regulations of the California Workers Compensation Insurance Rating Bureau (WCIRB). This requires each Enrolled Party to maintain payroll records for each Contract under the policy issued. Such records will allocate the payroll by Workers' Compensation classification(s) and exclude the excess or premium paid for overtime (i.e., only the straight-time rate will apply to overtime hours worked).
- **Insurance Company Payroll Audit -** Each Enrolled Party must properly classify payrolls, as these are reported to the rating bureau for calculation of future Experience Modifiers for the Enrolled Party's firm. All Enrolled Parties shall make available for inspection and copying their respective company books, vouchers, contracts, documents, and records, of all types, for physical inspection by the auditors of the OCIP insurance carrier(s) or Owner's representatives. Availability of records must be for a reasonable time during the policy period, any extension, or during a final audit period, as required by the OCIP Insurance Policies.

5.5 Contract Completion / Closeout Compliance

A. Contractor's Completion Notice

- Contractor's Completion Notice must be submitted to the Program Administrator via Wrap Portal, (www.keenanwrap.com) upon completion of contract work at the Project Site, which includes punch list items, but not warranty or service contract work.
- This form evidences all enrolled Contractors'/Subcontractors' actual start and completion dates, per each contract.
- Completion Notice information is reported to OCIP Insurance carrier to confirm coverage and payroll reporting requirements has ended for the contract.

6.0 Safety

It is the responsibility of each Subcontractor to maintain an environment free of recognized hazards. All Subcontractors shall exercise reasonable care to prevent work-related injuries; property and equipment damage at the Project, as well as minimize risk to the public and third-party property.

In the event of an accident, it shall be the responsibility of the employing and/or responsible Subcontractor to see that injured workers or members of the public are provided immediate medical treatment. All appropriate medical and claim forms must be filed in accordance with the claim procedures developed for this Project by Keenan & Associates, hereinafter called "Program Administrator." This includes notification to the appropriate state authorities, if necessary.

The Program Administrator shall conduct periodic loss control surveys on behalf of the District. These surveys will focus on evaluating the Subcontractors' efforts to minimize loss, assist in identifying loss exposures, and to recommend appropriate corrective measures. The Program Administrator is a resource to supplement the safety and loss prevention activity of Subcontractors. Its loss control survey activities or other activities of the Program Administrator and/or OCIP insurers do not in any way relieve the Contractors/Subcontractors of their responsibilities for Project safety.

6.1 Occupational Safety and Health Compliance

All Subcontractors are expected to comply with all applicable local, state, and federal occupational safety and health. If additional safety and health requirements are set forth in the contract specifications, all contractors shall comply with these requirements

In addition, local, state, and federal occupational safety and health laws, the following standards apply to all OCIP Enrolled and Non-Enrolled Contractors/Subcontractors.

6.2 Safety Orientation

a. Subcontractor employees shall be provided with a project specific safety orientation prior the start of the project. At a minimum, the orientation will address the following items:

   i. The District's site safety requirements.
   ii. Site specific safety hazards and protective measures for these hazards.
   iii. Emergency telephone numbers and procedures.
   iv. Local medical clinic/hospital information within the Medical Provider Network (MPN).

6.3 Program Management

a. Each Subcontractors shall have the following safety programs:

   i. Injury and Illness Prevention Plans
   ii. Hazard Communication Programs
   iii. Heat Illness Prevention Plans

b. Each Contractor/Subcontractor shall have an onsite competent person responsible for occupational safety and health.

6.4 Site Safety

According to industry practices, it is the responsibility of contractors of all tiers to exercise reasonable care to prevent work-related injuries; property and equipment damage at the project site, as well as minimize risk to the third-party persons and property. Subcontractors of all tiers shall be expected to comply with the following safety and loss control requirements:

a. All Subcontractors shall identify their contact person(s) to the General or Prime Contractor.

b. All Subcontractors shall follow District procedures for dealing with the media.

c. 100% protective eyewear with side shield protection is required while in the construction environment, shop, or anytime eye hazards exist. Protective eyewear shall bear a legible and permanent "Z87" logo to indicate compliance with applicable ANSI/ASSE Standard.

d. All construction employees shall wear clothing suitable for the weather and work conditions. At a minimum, this shall be short sleeved shirts, long pants, and leather or other protective work shoes or boots.

e. Alcohol is always prohibited on District property.

f. Contractors/Subcontractors will be required to respond to all District complaints about objectionable levels of dust or noise and will be required to provide prompt and appropriate abatement.

g. Construction personnel cannot enter District grounds other than the construction site unless accompanied by District personnel and are allowed only "incidental" contact with students. Violations of these requirements by any construction employee will result in a mandatory background check of that employee – including fingerprinting – as required by state law.

h. All prime contractors must attend the site-specific pre-construction meeting.

i. No sexual reference or preference shall be permitted on any piece of clothing or the hardhat. Any employee observed disregarding this policy shall be removed from the job site until further notice.

j. All Subcontractors shall control the break time activities of the employees to assure the cleanup of all soda cans, food wrappers, plastic bottles, or food containers from the break area. Such areas shall be cleaned immediately after the break and all waste placed in trash receptacles. No glass containers are permitted on the site.

k. Theft or willful damage to any property of the District, student, or other contractors will be prosecuted fully.

l. All Subcontractors will advise non-English speaking employees in their native language either in a written format or via an interpreter of these policies.

Incident Investigation Requirements

1. The contractor shall perform thorough, in-depth investigations and evaluations of all incidents. A formal incident investigation shall be conducted whenever any incident occurs, including, without limitation, both non-injury incidents and incidents involving first aid. Additionally, near miss accidents and/or incidents must be reported and undergo the same in-depth investigation, root cause analysis and lessons learned process.
2. Recommendations and lessons learned to prevent recurrence of incidents shall be documented and communicated to all employees of contractor and subcontractors through safety meetings and on-the-job training.

6.5 Mandatory 6' Fall Protection

a. Subcontractor employees shall be protected from fall exposures of **6 feet or greater**. Activities include but are not limited to:

   i. Steel erection
   ii. Decking
   iii. Roofing

iv. Framing
v. Scaffold work
vi. Work performed from ladders

b. A safety monitor as means of fall protection is prohibited.

c. Ladder jacks and lean-to scaffolds are prohibited.

d. Contractor/Subcontractors are required to provide training to their employees who might be exposed to a fall hazard prior to the exposure or upon hiring. This training shall be documented and available for review.

e. Methods of fall protection include but are not limited to the following:

i. Railings
ii. Covers for Floor, Roof, and Wall Openings
iii. Personal Fall Arrest Systems, Personal Fall Restraint Systems, and Positioning Devices
iv. Controlled Access Zones

f. The design and construction of railings shall conform to the Cal/OSHA Construction Safety Orders.

g. The minimum parapet height allowed for fall protection is 42 inches or greater.

h. Covers used to cover floor, roof, and wall openings shall be secured in place to prevent accidental removal or displacement and shall be marked in accordance in accordance with Cal/OSHA Construction Safety Orders.

i. Covers used to cover floor and roof openings shall be capable of safely supporting the greater of 400 pounds or twice the weight of the employees, equipment and materials that may be imposed on any one square foot area of the cover at any time.

j. Controlled access zones shall be defined by a control line or other means that restricts access. Each line shall have a minimum breaking strength of 200 pounds. Signs shall be posted to warn unauthorized employees to stay out of the controlled access zone.

k. Control lines shall consist of ropes, wires, tapes, or equivalent materials. Control lines shall be erected and supported in accordance with Cal/OSHA Construction Safety Orders.

l. Scaffold Access/Egress. An internal ladder system with hatches and drop-down ladders or temporary stairs shall be provided for safe access/egress on all scaffolds 20 feet or greater in height. External straight ladders are prohibited on all scaffolds if it exposes a user to a fall of 20 feet or greater in height.

6.6 Crane Safety

a. In accordance with Title 8, California Code of Regulations, section 5006.1, employers shall only permit operators who have a valid certificate (license) of competency to operate cranes. The operator shall have his license on his person, readily available for review.

a. All cranes used in lifting service, exceeding 3 tons rated capacity, and their accessory gear shall not be used until the employer has ascertained that such equipment has been certificated in accordance with Cal/OSHA as evidenced by current and valid documents. Certificates (annual and quadrennial) attesting to current compliance with testing and examination standards shall be maintained, readily available for each crane.

b. The contractor shall provide an erection plan and procedure for erection of trusses and beams over 25 feet long. The erection plan and procedure shall be prepared by a civil engineer currently registered in California. This plan and procedure shall be followed and kept available on the job site.

6.7 Return to Work

The District and OCIP Carrier are committed to working with all Enrolled Contractors and Subcontractors to promote the successful & timely return to work of injured employees following a work-related injury. The purpose of this policy is to ensure that Enrolled Contractor/Subcontractor employees who temporarily cannot return to their normal duties due to job-related injury or illness but can safely perform transitional duties while recovering is offered appropriate transitional duties for a limited time only.

a. An employee who has experienced a job-related injury requiring medical treatment must provide a proper medical release prior to returning to work.

b. An employee who has been removed from the jobsite ambulatory must provide a proper medical release prior to returning to work.

c. Each Enrolled Contractor/Subcontractor will cooperate with the OCIP Carrier to facilitate the return to work of any injured employee capable of safely performing transitional duties.

d. When the employee is released to transitional duties, it is the Enrolled Contractor/Subcontractor's responsibility to facilitate the injured employee's return to work.

e. The Enrolled Contractor/Subcontractor shall fully accommodate the injured employee and facilitate the return to work.

f. It will be the responsibility of the Insurance Carrier's Adjuster to maintain communication with the treating physician and the Enrolled Contractor/Subcontractor to facilitate the prompt return of an employee to full work status.

7.0 Claims Reporting

Accident/Claims Reporting Procedures - Overview

This section describes the basic procedures for reporting SEWUP claims: Workers' Compensation, General Liability, Pollution Liability, and Damage to the Project (Builders Risk).

The OCIP Administrator provides an Accident Claims Reporting Guide to Enrolled Contractors and Subcontractors. The Accident Claims Reporting Guide provides instructions and necessary information for reporting a claim, including policy numbers and site location codes. **This manual includes the required claim forms and postings**. Additional claim forms can be obtained from the OCIP Administrator upon request.

7.1 Workers' Compensation Claim Reporting & Procedures

If the injury requires a doctor (or medical office) visit or involves lost time, please follow the procedures listed below.

Contractors'/Subcontractors' on-site personnel must follow these procedures if any employee is involved in an accident or occurrence resulting in bodily injury or death:

The main responsibility for any Contractor and Subcontractor is first to see that the injured worker receives immediate medical care. Immediately contact 911 for any serious, traumatic, and life-threatening injuries.

If an employee reports a work injury or illness that is minor and does not require a doctor visit or time off from work, the supervisor should refer the employee to the nearest **First Aid Treatment** available at the jobsite.

Call Liberty Mutual Insurance Company at **1-800-362-0000 or email them at** **CLclaimsreports@libertymutual.com** to report the injury. Access the Workers' Compensation Claim Kit, sent to you by the Program Administrator, which contains forms to be completed by employee and employer, as well as accident reporting guidelines. Have the following items ready when reporting the claim:

- SEWUP **Workers' Compensation Policy Number (Provided at time of enrollment)**
- SEWUP **Site Location Code**

Medical Provider Network (MPN)

Liberty Mutual Insurance, the Statewide Educational Wrap Up Program's insurance carrier, has implemented the following Medical Provider Network (MPN):

Liberty Mutual Insurance MPN

The above MPN is to be utilized for the medical treatment of injured employees, unless the employee has pre-designated their medical provider prior to the date of loss. In emergency situations, it is always recommended that the injured worker be treated at an emergency medical facility first, and then sent to a physician in the Medical Provider Network (MPN).

MPN Regulations & Guidelines:

- California MPN rules and regulations require that the injured worker must receive the Full Written MPN Notification when an injury is reported, or at the time of injury. The English version is given to English speaking employees and the Spanish version is given to Spanish speaking employees. The Full Written MPN Notification must also be given to the injured worker when changing to and transferring open claims to the Gallagher Bassett Platinum MPN.
- The MPN regulations are silent about Employee Acknowledgement Letters. As an employer, you have the right to use acknowledgement letters for your employees to sign when you give your employee the Full Written MPN Notification.
- An MPN Panel Card shall be posted at SEWUP Project Jobsite, Displaying the Name, Address and a Map of Designated Medical Clinic close to the jobsite.
- **For locating participating medical providers** within the Liberty Mutual Insurance MPN, use your Internet Browser to access the below website, which will provide links for locating a medical provider within the network by specialty and by location,

  https://lmi.co/LMnetworks

State Required Workers' Compensation Forms

The Labor Code requires that an employee report any injury immediately to the employer. There are essential requirements for both the employer and employee to perform, once the injury has been reported.

The Labor Code provides for possible penalties to be assessed if the following time lines are not met:

- Provision of the Employee Claim Form, DWC-1; report within one (1) working day of the employer's knowledge of a disability or injury beyond first aid. Each employer is responsible for providing this form to an injured employee. Should the employee not be available for hand delivery, mail the DWC-1 to the employee at their home address.
- Provision of the Employer's Report of Injury, Form 5020; report, within five (5) days of knowledge, every occupational injury or illness which results in lost time beyond the date of the incident, or requires medical treatment at a medical facility. In addition, every serious illness/injury or death must be reported immediately by telephone or fax to the nearest office of the California Division of Occupational Safety and Health.

7.2 General Liability Claim Reporting

Contractors/Subcontractor must immediately report all known or suspected First Party, Third Party or Pollution Liability incidents occurring at the Project Site involving bodily injury, death, or any damage to property to the following:

- Keenan & Associates - **1-310-212-0363 x.2011**. Have the following information ready when reporting claim
    - SEWUP **General Liability Policy Number**
    - SEWUP **Site Location Code**
- Program Administrator (SEWUP) – Email: SEWUP@keenan.com, Phone: (800) 654-8102 or Fax: (310) 787-8838. Notice of Occurrence - Accident/Incident Report may be email or faxed.

Note:
Always take appropriate emergency measures to prevent additional injury or damage, including contacting police and fire authorities as required by law.

7.3 Builder's Risk Claim Reporting

Contractors/Subcontractors must immediately report all property damage to your work or work of any other Contractor/Subcontractor at the Project Site, to the following:

- Ace USA Property Claims – Email: Propertyfirstnotices@acegroup.com, Phone: (800) 433-0385, or Fax: (302) 467-7855
- Program Administrator (SEWUP) – Email: SEWUP@keenan.com, Phone: (800) 654-8102 or Fax: (310) 787-8838

Note:
Always take appropriate emergency measures to prevent additional injury or damage, including contacting police and fire authorities as required by law.

7.3 Contractor's Pollution Liability Claim Reporting

Contractors/Subcontractors must immediately report all third-party accidents related to a known or suspected pollution incident at the Project Site involving bodily injury, death, or any damage to property to the following:

- Program Administrator (SEWUP) – Email: SEWUP@keenan.com, Phone: (800) 654-8102 or Fax: (310) 787-8838

7.4 Automobile Claim Reporting

NO coverage is provided for automobile accidents under the OCIP. It is the sole responsibility of each Contractor and Subcontractor to report claims involving their automobiles to their own insurance carrier.

7.5 Instructions and Procedures – Litigation Papers, Legal Documents, etc.

If your firm is served with a lawsuit arising out of your involvement with the Owner's Project, or if receipt of litigation papers or legal documents is your first notice of a claim, forward to the following:

- Program Administrator (SEWUP) – Email**:** SEWUP@keenan.com**,** Phone: (800) 654-8102 or Fax: (310) 787-8838

7.6 Investigation Assistance/Confirmation of Claim Receipt

All Contractors/Subcontractors will assist in the investigation of any accident or occurrence involving injury to persons or property. All Contractors/Subcontractors must cooperate with the companies involved in adjusting any claim by securing and giving evidence and obtaining the participation and attendance of witnesses required for the investigation and defense of any claim or suit.

Upon receipt of the claim or incident from the Contractor, the respective OCIP insurance carrier will send a claims acknowledgment letter with the assigned claims file number. Always cooperate with the Owner or the OCIP insurer representatives in the accident investigation.

8.0 Required Project Forms

- **8.1 First Report of Injury (5020)**
- **8.2 Workers' Compensation Claim Form (DWC-1)**
- **8.3 Notice of Occurrence - Accident/Incident Report – General Liability, Pollution, Builders Risk**

8.1 First Report of Injury (5020)

District Name: _____

Project Name: _____

State of California **EMPLOYER'S REPORT OF OCCUPATIONAL INJURY OR ILLNESS**	PLEASE COMPLETE (TYPE, IF POSSIBLE). MAIL TWO COPIES TO:	**OSHA CASE NO.** ☐ FATALITY

Any person who makes or causes to be made any knowingly false or fraudulent material statement or material representation for the purpose of obtaining or denying workers compensation benefits or payments of guilty of a felony.

NOTICE: California law requires employers to report within five days of knowledge every occupational injury or illness which results in lost time beyond the date of the incident OR requires medical treatment beyond first aid. If an employee subsequently dies as a result of a previously reported injury or illness, the employer must file within five days of knowledge an amended report indicating death. In addition, every serious illness/injury or death must be reported immediately by telephone or telegraph to the nearest office of the California Division of Occupational Safety and Health

EMPLOYER

1. FIRM NAME	1A. POLICY NUMBER	DO NOT USE THIS COLUMN
2. MAILING ADDRESS (Number and Street, City, ZIP)	2A. PHONE NUMBER	Case No.
3. LOCATION, IF DIFFERENT FROM MAILING ADDRESS (Number and Street, City, ZIP)	3A. LOCATION CODE	Ownership
4. NATURE OF BUSINESS, e.g., painting contractor, wholesale grocer, sawmill, hotel, etc.	5. STATE UNEMPLOYMENT INSURANCE ACCT NUMBER	Industry
6. TYPE OF EMPLOYER ☐ PRIVATE ☐ STATE ☐ CITY ☐ COUNTY ☐ SCHOOL DIST. ☐ OTHER GOV. – SPECIFY _____		Occupation

EMPLOYEE

7. EMPLOYEE NAME	8. SOCIAL SECURITY NUMBER	9. DATE OF BIRTH (mm dd yy)	Sex
10 HOME ADDRESS (Number and Street, City, ZIP)		10A. PHONE NUMBER	Age
11. SEX ☐ MALE ☐ FEMALE	12. OCCUPATION (Regular job title – NO initials, abbreviations or numbers)	13 DATE OF HIRE (mm dd yy)	Daily Hours
14 EMPLOYEE USUALLY WORKS _____ hours per day _____ days per week _____ total wkly. hrs	14A EMPLOYMENT STATUS (check applicable status at time of injury) ___ regular full-time ___ part time temp. ___ seasonal	14B Under what class code of your policy were wages assigned	Days/week
15 GROSS WAGES/SALARY $_____ PER _____	16 OTHER PAYMENTS NOT REPORTED AS WAGES/Salary (e.g., tips, meals, lodging, overtime, bonuses, etc.)? ☐ YES $_____ PER _____ ☐ NO		Weekly Hours

INJURY OR ILLNESS

17. DATE OF INJURY OR ONSET OF ILLNESS (mm dd yy)	18 TIME INJURY ILLNESS OCCURRED A.M. P.M.	19 TIME EMPLOYEE BEGAN WORK A.M. P.M.	20. IF EMPLOYEE DIED, DATE OF DEATH (mm dd yy)	Weekly Wage
21 UNABLE TO WORK FOR AT LEAST ONE FULL DAY AFTER DATE OF INJURY ☐ YES ☐ NO	22. DATE LAST WORKED (mm dd yy)	23. DATE RETRUNED TO WORK (mm dd yy)	24. IF STILL OFF WORK CHECK THIS BOX ☐	County
25. PAID FULL WAGES FOR DAY OF INJURY OR LAST DAY WORKED ☐ YES ☐ NO	26. SALARY BEING CONT'D? ☐ YES ☐ NO	27. DATE OF EMPLOYER'S KNOWLEDGE NOTICE OF INJURY/ILLNESS (mm dd yy)	28. DATE EMPLOYEE WAS PROVIDED EMPLOYEE CLAIM FORM (mm dd yy)	Nature of Injury
29. SPECIFIC INJURY/ILLNESS AND PART OF BODY AFFECTED, MEDICAL DIAGNOSIS, if available , e.g., second degree burns on right arm, tendonitis of left elbow, lead poisoning				Part of Body
30. LOCATION WHERE EVENT OR EXPOSURE OCCURRED (Number and Street, City)	30A COUNTY	30B. ON EMPLOYER'S PREMISES ☐ YES ☐ NO		Source
31 DEPARTMENT WHERE EVENT OR EXPOSURE OCCURRED, e.g. shipping department, machine shop.		32. OTHER WORKERS INJURED/ ILL IN THIS EVENT? ☐ YES ☐ NO		Event
33. EQUIPMENT, MATERIALS AND CHEMICALS THE EMPLOYEE WAS USING WHEN EVENT OR EXPOSURE OCCURRED, e.g., acetylene, welding torch, farm tractor, scaffold				Sec. Source
34. SPECIFIC ACTIVITY THE EMPLOYEE WAS PERFORMING WHEN EVENT OR EXPOSURE OCCURRED, e.g., welding seams of metal forms, loading boxes into truck				Extent of Injury
35 HOW INJURY/ILLNESS OCCURRED. DESCRIBE SEQUENCE OF EVENTS SPECIFY OBJECT OR EXPOSURE WHICH DIRECTLY PRODUCED THE INJURY/ILLNESS (e.g., worker stepped back to inspect work and slipped on scrap material. As he fell, he brushed against fresh weld and burned right hand). USE SEPARATE SHEET IF NECESSARY				
36. NAME AND ADDRESS OF PHYSICIAN (Number and Street, City, ZIP)			36A. PHONE NUMBER	
37 IF HOSPITALIZED AS AN INPATIENT, NAME AND ADDRESS OF HOSPITAL (Number and Street, City, ZIP)			37A. PHONE NUMBER	

COMPLETED BY (type or print)	SIGNATURE	TITLE	DATE

8.2 Workers' Compensation Claim Form (DWC-1)

Formulario de Reclamo de Compensación para Trabajadores (DWC 1) y Notificación de Posible Elegibilidad

If you are injured or become ill, either physically or mentally, because of your job, including injuries resulting from a workplace crime, you may be entitled to workers' compensation benefits. Attached is the form for filing a workers' compensation claim with your employer. **You should read all of the information below.** Keep this sheet and all other papers for your records. You may be eligible for some or all of the benefits listed depending on the nature of your claim. If required you will be notified by the claims administrator, who is responsible for handling your claim, about your eligibility for benefits.

To file a claim, complete the "Employee" section of the form, keep one copy and give the rest to your employer. Your employer will then complete the "Employer" section, give you a dated copy, keep one copy and send one to the claims administrator. Benefits can't start until the claims administrator knows of the injury, so complete the form as soon as possible.

Medical Care: Your claims administrator will pay all reasonable and necessary medical care for your work injury or illness. Medical benefits may include treatment by a doctor, hospital services, physical therapy, lab tests, x-rays, and medicines. Your claims administrator will pay the costs directly so you should never see a bill. For injuries occurring on or after 1/1/04, there is a limit on some medical services.

The Primary Treating Physician (PTP) is the doctor with the overall responsibility for treatment of your injury or illness. Generally your employer selects the PTP you will see for the first 30 days, however, in specified conditions, you may be treated by your predesignated doctor. If a doctor says you still need treatment after 30 days, you may be able to switch to the doctor of your choice. Special rules apply if your employer offers a Health Care Organization (HCO) or after 1/1/05, has a medical provider network. Contact your employer for more information. If your employer has not put up a poster describing your rights to workers' compensation, you may choose your own doctor immediately.

Within one working day after an employee files a claim form, the employer shall authorize the provision of all treatment, consistent with the applicable treating guidelines, for the alleged injury and shall continue to provide treatment until the date that liability for the claim is accepted or rejected. Until the date the claim is accepted or rejected, liability for medical treatment shall be limited to ten thousand dollars ($10,000).

Disclosure of Medical Records: After you make a claim for workers' compensation benefits, your medical records will not have the same privacy that you usually expect. If you don't agree to voluntarily release medical records, a workers' compensation judge may decide what records will be released. If you request privacy, the judge may "seal" (keep private) certain medical records.

Payment for Temporary Disability (Lost Wages): If you can't work while you are recovering from a job injury or illness, you will receive temporary disability payments. These payments may change or stop when your doctor says you are able to return to work. These benefits are tax-free. Temporary disability payments are two-thirds of your average weekly pay, within minimums and maximums set by state law. Payments are not made for the first three days you are off the job unless you are hospitalized overnight or cannot work for more than 14 days.

Si Ud. se lesiona o se enferma, ya sea física o mentalmente, debido a su trabajo, incluyendo lesiones que resulten de un crimen en el lugar de trabajo, es posible que Ud. tenga derecho a beneficios de compensación para trabajadores. Se adjunta el formulario para presentar un reclamo de compensación para trabajadores con su empleador. **Ud. debe leer toda la información a continuación.** Guarde esta hoja y todos los demás documentos para sus archivos. Es posible que usted reúna los requisitos para todos los beneficios, o parte de éstos, que se enumeran, dependiendo de la índole de su reclamo. Si se requiere, el/la administrador(a) de reclamos, quien es responsable del manejo de su reclamo, le notificará a usted, lo referente a su elegibilidad para beneficios.

Para presentar un reclamo, complete la sección del formulario designada para el "Empleado", guarde una copia, y déle el resto a su empleador. Entonces, su empleador completará la sección designada para el "Empleador", le dará a Ud. una copia fechada, guardará una copia, y enviará una al/a la administrador(a) de reclamos. Los beneficios no pueden comenzar hasta, que el/la administrador(a) de reclamos se entere de la lesión, así que complete el formulario lo antes posible.

Atención Médica: Su administrador(a) de reclamos pagará toda la atención médica razonable y necesaria, para su lesión o enfermedad relacionada con el trabajo. Es posible que los beneficios médicos incluyan el tratamiento por parte de un médico, los servicios de hospital, la terapia física, los análisis de laboratorio y las medicinas. Su administrador(a) de reclamos pagará directamente los costos, de manera que usted nunca verá un cobro. Para lesiones que ocurren en o después de 1/1/04, hay un límite de visitas para ciertos servicios médicos.

El Médico Primario que le Atiende-*Primary Treating Physician PTP* es el médico con toda la responsabilidad para dar el tratamiento para su lesion o enfermedad. Generalmente, su empleador selecciona al *PTP* que Ud. Verá durante los primeros 30 días. Sin embargo, en condiciones específicas, es posible que usted pueda ser tratado por su médico pre-designado. Si el doctor dice que usted aún necesita tratamiento después de 30 días, es possible que Ud. pueda cambiar al médico de su preferencia. Hay reglas especiales que son aplicables cuando su empleador ofrece una Organización del Cuidado Médico (HCO) o depués de 1/1/05 tiene un Sistema de Proveedores de Atención Médica. Hable con su empleador para más información. Si su empleador no ha colocado un poster describiendo sus derechos para la compensación para trabajadores, Ud. puede seleccionar a su propio medico inmediatamente.

El empleador autorizará todo tratamiento médico consistente con las directivas de tratamiento applicables a la lesión o enfermedad, durante el primer día laboral después que el empleado efectúa un reclamo para beneficios de compensación, y continuará proveyendo este tratamiento hasta la fecha en que el reclamo sea aceptado o rechazado. Hasta la fecha en que el reclamo sea aceptado o rechazado, el tratamiento médico será limitado a diez mil dólares ($10,000).

Divulgación de Expedientes Médicos: Después de que Ud. presente un reclamo para beneficios de compensación para los trabajadores, sus expedientes médicos no tendrán la misma privacidad que usted normalmente espera. Si Ud. no está de acuerdo en divulgar voluntariamente los expedientes médicos, un(a) juez de compensación para trabajadores posiblemente decida qué expedientes se revelarán. Si Ud. Solicita privacidad, es posible que el/la juez "selle" (mantenga privados) ciertos expedientes médicos.

Pago por Incapacidad Temporal (Sueldos Perdidos): Si Ud. no puede trabajar, mientras se está recuperando de una lesión o enfermedad relacionada con el trabajo, Ud. recibirá pagos por incapacidad temporal. Es posible que estos pagos cambien o paren, cuando su médico diga que Ud. está en condiciones de regresar a trabajar. Estos beneficios son libres de impuestos. Los pagos por incapacidad temporal son dos tercios de su pago semanal promedio, con cantidades mínimas y máximas establecidas por las leyes estatales. Los pagos no se hacen durante los primeros tres

Return to Work: *To help you to return to work as soon as* pos
you should actively communicate with your treating do
claims administrator, and employer about the kinds of work you can do while recovering. They may coordinate efforts to return you to modified duty or other work that is medically appropriate. This modified or other duty may be temporary or may be extended depending on the nature of your injury or illness.

Payment for Permanent Disability: If a doctor says your injury or illness results in a permanent disability, you may receive additional payments. The amount will depend on the type of injury, your age, occupation, and date of injury.

Vocational Rehabilitation (VR): If a doctor says your injury or illness prevents you from returning to the same type of job and your employer doesn't offer modified or alternative work, you may qualify for VR. If you qualify, your claims administrator will pay the costs, up to a maximum set by state law. VR is a benefit for injuries that occurred prior to 2004.

Supplemental Job Displacement Benefit (SJDB): If you do not return to work within 60 days after your temporary disability ends, and your employer does not offer modified or alternative work, you may qualify for a nontransferable voucher payable to a school for retraining and/or skill enhancement. If you qualify, the claims administrator will pay the costs up to the maximum set by state law based on your percentage of permanent disability. SJDB is a benefit for injuries occurring on or after 1/1/04.

Death Benefits: If the injury or illness causes death, payments may be made to relatives or household members who were financially dependent on the deceased worker.

It is illegal for your employer to punish or fire you for having a job injury or illness, for filing a claim, or testifying in another person's workers' compensation case (Labor Code 132a). If proven, you may receive lost wages, job reinstatement, increased benefits, and costs and expenses up to limits set by the state.

You have the right to disagree with decisions affecting your claim. If you have a disagreement, contact your claims administrator first to see if you can resolve it. If you are not receiving benefits, you may be able to get State Disability Insurance (SDI) benefits. Call State Employment Development Department at (800) 480-3287.

You can obtain free information from an information and assistance officer of the State Division of Workers' Compensation, or you can hear recorded information and a list of local offices by calling **(800) 736-7401**. You may also go to the DWC web site at **www.dir.ca.gov**. Link to Workers' Compensation.

You can consult with an attorney. Most attorneys offer one free consultation. If you decide to hire an attorney, his or her fee will be taken out of some of your benefits. For names of workers' compensation attorneys, call the State Bar of California at (415) 538-2120 or go to their web site at **www.californiaspecialist.org**.

ıs en que Ud. no trabaje, a menos que Ud. sea hospitalizado(a) de
ıche, o no pueda trabajar durante más de 14 días.

Regreso al Trabajo: Para ayudarle a regresar a trabajar lo antes posible, Ud. debe comunicarse de manera activa con el médico que le atienda, el/la administrador(a) de reclamos y el empleador, con respecto a las clases de trabajo que Ud. puede hacer mientras se recupera. Es posible que ellos coordinen esfuerzos para regresarle a un trabajo modificado, o a otro trabajo, que sea apropiado desde el punto de vista médico. Este trabajo modificado, u otro trabajo, podría extenderse o no temporalmente, dependiendo de la índole de su lesión o enfermedad.

Pago por Incapacidad Permanente: Si el doctor dice que su lesión o enfermedad resulta en una incapacidad permanente, es posible que Ud. reciba pagos adicionales. La cantidad dependerá de la clase de lesión, su edad, su ocupación y la fecha de la lesión.

Rehabilitación Vocacional: Si el doctor dice que su lesión o enfermedad no le permite regresar a la misma clase de trabajo, y su empleador no le ofrece trabajo modificado o alterno, es posible que usted reúna los requisitos para rehabilitación vocacional. Si Ud. reúne los requisitos, su administrador(a) de reclamos pagará los costos, hasta un máximo establecido por las leyes estatales. Este es un beneficio para lesiones que ocurrieron antes de 2004.

Beneficio Suplementario por Desplazamiento de Trabajo: Si Ud. No vuelve al trabajo en un plazo de 60 días después que los pagos por incapcidad temporal terminan, y su empleador no ofrece un trabajo modificado o alterno, es posible que usted reúne los requisitos para recibir un vale no-transferible pagadero a una escuela para recibir un Nuevo entrenamiento y/o mejorar su habilidad. Si Ud. reúne los requisitios, el administrador(a) de reclamos pagará los costos hasta un máximo establecido por las leyes estatales basado en su porcentaje del incapicidad permanente. Este es un beneficio para lesiones que ocurren en o después de 1/1/04.

Beneficios por Muerte: Si la lesión o enfermedad causa la muerte, es posible que los pagos se hagan a los parientes o a las personas que vivan en el hogar, que dependían económicamente del/de la trabajador(a) difunto(a).

Es ilegal que su empleador le castigue o despida, por sufrir una lesión o enfermedad en el trabajo, por presentar un reclamo o por atestiguar en el caso de compensación para trabajadores de otra persona. (El Codigo Laboral sección 132a). Si es probado, puede ser que usted reciba pagos por perdida de sueldos, reposición del trabajo, aumento de beneficios, y gastos hasta un límite establecido por el estado. Ud. tiene derecho a estar en desacuerdo con las decisiones que afecten su reclamo. Si Ud. tiene un desacuerdo, primero comuníquese con su administrador(a) de reclamos, para ver si usted puede resolverlo. Si usted no está recibiendo beneficios, es posible que Ud. pueda obtener beneficios de Seguro Estatal de Incapacidad (SDI). Llame al Departamento Estatal del Desarrollo del Empleo (EDD) al (800) 480-3287.

Ud. puede obtener información gratis, de un oficial de información y asistencia, de la División estatal de Compensación al Trabajador *(Division of Workers' Compensation – DWC)*, o puede escuchar información grabada, así como una lista de oficinas locales, llamando al **(800) 736-7401**. Ud. también puede ir al sitio electrónico en el Internet de la DWC en **www.dir.ca.gov.** Enlácese a la sección de Compensación para Trabajadores.

Ud. puede consultar con un(a) abogado(a). La mayoría de los abogados ofrecen una consulta gratis. Si Ud. decide contratar a un(a) abogado(a), sus honorarios se tomarán de sus beneficios. Para obtener nombres de abogados de compensación para trabajadores, llame a la Asociación Estatal de Abogados de California *(State Bar)* al (415) 538-2120, ó vaya a su sitio electrónico en el Internet en **www.californiaspecialist.org**.

DIVISION OF WORKERS' COMPENSATION

Estado de California
Departamento de Relaciones Industriales
DIVISION DE COMPENSACIÓN AL TRABAJADOR

WORKERS COMPENSATION CLAIM FORM (DWC 1)

PETITION DEL EMPLEADO PARA DE COMPENSACIÓN DEL TRABAJADOR (DWC 1)

Employee: Complete the **"Employee"** section and give the form to your employer. Keep a copy and mark it **"Employee's Temporary Receipt"** until you receive the signed and dated copy from your employer. You may call the Division of Workers' Compensation and hear recorded information at **(800) 736-7401**. An explanation of workers' compensation benefits is included as the cover sheet of this form.

You should also have received a pamphlet from your employer describing workers' compensation benefits and the procedures to obtain them.

Any person who makes or causes to be made any knowingly false or fraudulent material statement or material representation for the purpose of obtaining or denying workers' compensation benefits or payments is guilty of a felony.

Empleado: *Complete la sección* ***"Empleado"*** *y entregue la forma a su empleador. Quédese con la copia designada* ***"Recibo Temporal del Empleado"*** *hasta que Ud. reciba la copia firmada y fechada de su empleador. Ud. puede llamar a la Division de Compensación al Trabajador al* ***(800) 736-7401*** *para oir información gravada. En la hoja cubierta de esta forma esta la explicatión de los beneficios de compensación al trabjador.*

Ud. también debería haber recibido de su empleador un folleto describiendo lo s benficios de compensación al trabajador lesionado y los procedimientos para obtenerlos.

Toda aquella persona que a propósito haga o cause que se produzca cualquier declaración o representación material falsa o fraudulenta con el fin de obtener o negar beneficios o pagos de compensación a trabajadores lesionados es culpable de un crimen mayor "felonia".

Employee—complete this section and see note above. ***Empleado—complete esta sección y note la notación arriba.***

1. Name. *Nombre.* _____ Today's Date. *Fecha de Hoy.* _____
2. Home Address. *Dirección Residencial.* _____
3. City. *Ciudad.* _____ State. *Estado.* _____ Zip. *Código Postal.* _____
4. Date of Injury. *Fecha de la lesión (accidente).* _____ Time of Injury. *Hora en que ocurrió.* _____ a.m. _____ p.m.
5. Address and description of where injury happened. *Dirección/lugar dónde occurió el accidente.* _____
   _____
6. Describe injury and part of body affected. *Describa la lesión y parte del cuerpo afectada.* _____
   _____
7. Social Security Number. *Número de Seguro Social del Empleado.* _____
8. Signature of employee. *Firma del empleado.* _____

Employer—complete this section and see note below. ***Empleador—complete esta sección y note la notación abajo.***

9. Name of employer. *Nombre del empleador.* _____
10. Address. *Dirección.* _____
11. Date employer first knew of injury. *Fecha en que el empleador supo por primera vez de la lesión o accidente.* _____
12. Date claim form was provided to employee. *Fecha en que se le entregó al empleado la petición.* _____
13. Date employer received claim form. *Fecha en que el empleado devolvió la petición al empleador.* _____
14. Name and address of insurance carrier or adjusting agency. *Nombre y dirección de la compañía de seguros o agencia adminstradora de seguros.*
    _____
15. Insurance Policy Number. *El número de la póliza de Seguro.* _____
16. Signature of employer representative. *Firma del representante del empleador.* _____
17. Title. *Título.* _____ 18. Telephone. *Teléfono.* _____

Employer: You are required to date this form and provide copies to your insurer or claims administrator and to the employee, dependent or representative who filed the claim within **one working day** of receipt of the form from the employee.

SIGNING THIS FORM IS NOT AN ADMISSION OF LIABILITY

Empleador: *Se requiere que Ud. feche esta forma y que provéa copias a su compañía de seguros, administrador de reclamos, o dependiente/representante de reclamos y al empleado que hayan presentado esta petición dentro del plazo de* ***un día hábil*** *desde el momento de haber sido recibida la forma del empleado.*

EL FIRMAR ESTA FORMA NO SIGNIFICA ADMISION DE RESPONSABILIDAD

❑ Employer copy
Copia del Empleador

❑ Employee copy
Copia del Empleado

❑ Claims Administrator
Administrador de Reclamos

❑ Temporary Receipt/
Recibo del Empleado

8.3 Notice of Occurrence - Accident/Incident Report – General Liability, Pollution, Builders Risk

SEWUP

Notice of Occurrence

ACCIDENT / INCIDENT REPORT – GENERAL LIABILITY/POLLUTION/BUILDERS RISK

Keenan & Associates 2355
Crenshaw Blvd. Torrance, CA 90501
www.SEWUP.ORG
Licence No. 0451271

Date:

Contact:	Project Location Code:	Date of Loss & Time:	☐ AM ☐ PM
Phone:			
Cell:	Carrier:		NAIC Code:
Fax:			
Email:	Policy No.:		Client ID No.:

School District

Name of Insured:		Insureds Mailing Address:	
Contact Name:	Title:		
Primary Phone: ☐ Bus ☐ Cell	Secondary Phone: ☐ Bus ☐ Cell	Primary Email:	Secondary Email:

Contractor

Name of Insured:		Insureds Mailing Address:	
Contact Name:	Title:		
Primary Phone: ☐ Bus ☐ Cell	Secondary Phone: ☐ Bus ☐ Cell	Primary E-mail:	Secondary E-mail:

Occurrence

Location of Occurrence / Address (Describe Location if No Specific Address):	Police or Fire Dept. Contacted?
	Report No.:
Description of Occurrence:	

Property

Premises: Claimant (1) is: ☐ Owner ☐ Tenant ☐ Insured Party		Premises: Claimant (2) is: ☐ Owner ☐ Tenant ☐ Insured Party	
Type of Damage:		Type of Damage:	
Damaged Party (1) Name & Address (If not insured):		Damaged Party (2) Name & Address (If not insured):	
Primary Phone:	☐ Home ☐ Bus. ☐ Cell	Primary Phone:	☐ Home ☐ Bus. ☐ Cell
Secondary Phone:	☐ Home ☐ Bus. ☐ Cell	Secondary Phone:	☐ Home ☐ Bus. ☐ Cell
Primary Email:		Primary Email:	
Secondary Email:		Secondary Email:	
Location of Property for Inspection:		Location of Property for Inspection:	

SEWUP - Notice of Occurrence Page 1 of 2

Injured Party

Damaged Party (1) Name & Address (If not insured):		Damaged Party (2) Name & Address (If not insured):	
Primary Phone:	☐Home ☐Bus ☐Cell	Primary Phone:	☐Home ☐Bus ☐Cell
Secondary Phone:	☐Home ☐Bus ☐Cell	Secondary Phone:	☐Home ☐Bus ☐Cell
Primary E-mail:		Primary E-mail:	
Secondary E-mail:		Secondary E-mail:	
Age: Sex: Occupation:		Age: Sex: Occupation:	
Where Taken:		Where Taken:	
Describe Injury:		Describe Injury:	
What Was Injured Doing:		What Was Injured Doing:	

Witnesses

Damaged Party (1) Name & Address (If not insured):		Damaged Party (2) Name & Address (If not insured):	
Primary Phone:	☐Home ☐Bus ☐Cell	Primary Phone:	☐Home ☐Bus ☐Cell
Secondary Phone:	☐Home ☐Bus ☐Cell	Secondary Phone:	☐Home ☐Bus ☐Cell
Primary E-mail:		Primary E-mail:	
Secondary E-mail:		Secondary E-mail:	

Remarks

Reported By:	Reported To:

SEWUP - Notice of Occurrence Page 2 of 2

9.0 Frequency Asked Questions (FAQs)

An Owner Controlled Insurance Program (OCIP) Through The Statewide Educational Wrap Up Program (SEWUP)

1. **Who is insured under an Owner Controlled Insurance Program?**

   The Owner and all enrolled Contractors and their enrolled Subcontractors of any tier who perform operations at the Project Site described in the Contract Documents are insured under the OCIP.

2. **Who is managing the Owner Controlled Insurance Program?**

   Keenan & Associates is the Program Administrator for this Owner Controlled Insurance Program, otherwise known as Statewide Educational Wrap Up Program (SEWUP).

3. **Is Project Site Defined?**

   Yes. Project Site is on file with the insurance company, as described in the applicable Contract Documents.

4. **What insurance is provided to Contractors/Subcontractors under the Owner Controlled Insurance Program (OCIP)?**

   The Owner has agreed to procure the following insurance:

   a. Workers' Compensation and Employer's Liability
   b. General Liability Insurance for Personal Injury, Bodily Injury and Property Damage Liability
   c. Builder's Risk
   d. Contractor's Pollution Liability (course of construction only)

5. **Does the OCIP cover any contractor's equipment?**

   No. Contractors and Subcontractors must maintain this coverage.

6. **Are there other types of insurance normally purchased by Contractors, which are not included?**

   Yes. Examples are:

   a. Bonds, if required by contract
   b. Contractor's Automobile Liability and Physical Damage Insurance
   c. Contractor's Equipment Floater

7. **Does the Contractor/Subcontractor insured under the OCIP have to provide evidence of insurance?**

Yes. The contract requires that, prior to commencement of on-site activities; each Contractor/Subcontractor shall furnish a Certificates of Insurance evidencing coverage for:

a. Workers' Compensation
b. General Liability

Certificates of Insurance and Additional Named Insured Endorsements, specifically naming the Owner, are also required for:

a. Automobile Liability
b. Any other required coverages outlined in the Contract and the Project Insurance Manual.

8. **How is the Contractor/Subcontractor's bid to be submitted?**

The Contractor/Subcontractor needs to submit their bid excluding certain insurance costs, as outlined in the Contract. Change Orders also need to be submitted without insurance costs.

9. **When will the Contractor/Subcontractor receive a Certificate of Insurance insuring them under the OCIP?**

Eligible Contractors/Subcontractors awarded a contract will be furnished a Certificate of Insurance upon Program Administrator's review and acceptance of the Contract Enrollment via Wrap Portal.

10. **Will all Contractors/Subcontractors receive information concerning their loss experience?**

This information is available, upon request, from the Program Administrator.

11. **How long are the policies kept in-force for the Contractor/Subcontractor?**

The policy periods commence on the date of "Award" and terminate as defined in the Contract Documents. The only extension is for General Liability "Completed Operations" which is for ten (10) years after Notice of Completion filed by the District.

12. **Does the OCIP provide coverage for truckers, vendors and suppliers?**

No. Contractors/Subcontractors, whose sole duties are as truckers, vendors, or suppliers are not included in the program. If contracted with an on-site installer, vendors and/or suppliers should be enrolled in the OCIP for General Liability only, as it pertains to the contractual relationship of the installer's on-site work.

13. Are all Contractors/Subcontractors, of any tier, required to complete their own OCIP enrollment, before they will be allowed to begin job site activity?

All Contractors/Subcontractors, regardless of tier, must complete a Contract Enrollment via Wrap Portal, prior to commencement of on-site activities. Upon acceptance by the OCIP Administrator, each Contractor/Subcontractor will receive an enrollment confirmation packet, which includes a Certificate of Insurance evidencing the OCIP coverages.

14. What document do I use to show my Agent/Broker and Insurer that I'm covered under the OCIP?

All contractors enrolled under the OCIP program receive individual workers' compensation policies and Certificates of Insurance evidencing coverage under the OCIP program.

Workers' Compensation and Employers' Liability Insurance Questions

1. What insurance company writes the Workers' Compensation and Employer's Liability coverage?

Liberty Mutual Insurance Company.

2. What is the coverage term?

The coverage term for each Contractor/Subcontractor will coincide with the Start Date provided at OCIP enrollment. OCIP Workers' Compensation policies are renewed each year until receipt of OCIP Contractor's Completion Notice.

3. How will the Contractor/Subcontractor's payroll be classified?

Insurance Company will classify payrolls in accordance with California law under the Workers' Compensation Insurance Rating Bureau regulations, classifications, rates and rating plans. The Monthly Project Site Payroll Form will be used for Contractors/Subcontractors' monthly payroll submissions.

4. **Will Program Administrator inspect the job and make recommendations regarding loss control and safety?**

Yes. The Program Administrator will conduct periodic loss control surveys on behalf of the Owner. These surveys will focus on evaluating the contractors' efforts to control Workers' Compensation, General Liability, and Builders Risk exposures. These surveys are intended to assist contractors in identifying these exposures and take the appropriate actions to minimize the likelihood of loss.

5. **Will there be other people who will make job site inspections?**

Yes. The insurance company's Risk Engineer may conduct periodic site inspections to verify compliance with State requirements. State, City and Federal inspectors may also make inspections.

General Liability Insurance for Personal Injury, Bodily Injury and Property Damage Liability Questions

What insurance company writes the Personal Injury, Bodily Injury, and Property Damage Liability coverage? Lloyds of London.

Is Completed Operations coverage provided beyond acceptance of the work performed under the Contract?

Yes. The extension for General Liability "completed operations" is for ten (10) years after Notice of Completion is filed by the Owner, or date Occupancy is taken.

10.0 Known Policy Exclusions

Workers Compensation

Bodily Injury Outside US or Canada
Bodily Injury to Any Member of Flying Crew
Bodily Injury to Person Subject to Federal Workers' Compensation
Bodily Injury to Person Subject to Occupational Disease Laws
Contractual Liability
Employees Knowingly Employed Illegally
Employment Related Practices
Intentional or Aggravated Bodily Injury
Obligations Imposed by Disability Benefits or Any Similar Law
Obligations Imposed by Occupational Disease Laws
Obligations Imposed by Unemployment Compensation Laws
Obligations Imposed by Workers' Compensation Laws
State or Federal Law Violation Fines, Penalties

General Liability

Aircraft, Auto or Watercraft
Asbestos
Certain Exclusions to Medical Payments Coverage
Certain Exclusions to Personal and Advertising Injury Liability
Certified Acts of Terrorism
Contractual Liability (Limited Coverage Provided)
Employers Liability
Employment Related Practices
Expected or Intended Injury
Exterior Insulation and Finish Systems (EIFS) "Subject to Installation Requirements"
Fungi or Bacteria
Lead
Mobile Equipment
Nuclear
Personal and Advertising Bodily Injury
Pollution
Prior Continuous, or Progressively Deteriorating Injury or Damage
Professional Liability

Recall of Products, Work or Impaired Property
Silica or Silica Mixed Dust
Violation of Statutes Governing Collecting, Transmitting Information
Violation of Statutes Governing Email, Fax, Phone Calls
War
Workers Compensation and Similar Laws

Builders Risk

Asbestos
Certain Offsite Property
Certain Release, Discharge, Escape, or Dispersal of Contaminants
Certified Acts of Terrorism (Can be added)
Cessation of Work
Contractor's Tools, Machinery, Plans, Equipment
Cost of Making Good
Damage to Existing Property (Can be added)
Damage While Testing Prototype or Used Machinery/Equipment
Damages, Fines, Penalties at Government Agency or Court Order
Disappearance or When Revealed by Inventory Shortage Alone
Earth Movement (Optional; can be added)
Electrical, Magnetic, or Errors Related to Electronic Records
Financial Accounts, Instruments, Stamps, Deeds, Precious Material
Flood (Optional; can be added)
Foreign Terrorism
Infidelity, Dishonesty, Fraudulent Activity of Insured
Land, Values of Land, Cut, & Fill etc. Prior to Project Commencement
Loss Under Any Manufacturer or Supplier Guarantee/Warranty
Normal Subsidence
Nuclear
Offshore or Barrier Island Property
Property That Stores, Processes, or Handles Radioactive Materials
Rolling Stock, Aircraft, Watercraft
Software Loss, unless results from an Open Peril
Standing Timber, Growing Crops, Animals
Vehicles or Equipment Licensed for Highway Use

War and Military Action
Contractors Pollution Liability
Auto, Aircraft, Vessel or Rolling Stock
Claims Between Certain Insured's
Contractual Liability
Damage to Property
Disposal Sites
Employment Related Practices
Fines, Penalties, and Treble Damages
Owner Hazardous Materials Facility
Intentional Acts
Nuclear
Other Entities
Pre-Existing Conditions
Products
Related Entities and Individuals
Transportation Of Pollutants
War
Workers Compensation and Similar Laws

COMPTON COMMUNITY COLLEGE DISTRICT

SCOPE OF WORK
RFQ CCC-055
Instructional Building 2

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Work Covered by Contract Documents

B. Contract Scope

C. Contractor Use of Premises

1.2 WORK COVERED BY CONTRACT DOCUMENTS:

A. **Work Included: The work to be performed by contractor shall conform to the requirements of all of Division 00 and Division 01 as well as the General Conditions, Special Conditions, and all related Specifications that pertain to this Bid Package scope of work, all sheets in Drawings and other related documents, and includes the furnishing of all supervision, labor, materials, tools, equipment, transportation, plan and services necessary therefore and incidental thereto to complete the project. The work shall consist of, but not be limited to, the following:**

a. This Contractor is to provide all necessary items to build the new Instructional Building 2 per plans and specifications. Accurately locate all scope of work for the entire project including but not necessarily limited to the following work: All lay out of project, including all grade staking, all protection of existing to remain in place, all concrete and asphalt cutting and demo, all abatement per Bainbridge reports provided, all over cutting and compaction, all removal, all base material, all earth work, site clearing, scarification, grading, earth moving, fill and compaction, finish grading, field engineering and preparations for the complete project, irrigation protection and repairs, capping and preparation of existing utilities, soil amendments, all paving, all construction signs, all disposal of excess materials, all final clean up and demobilization, and all other required materials, equipment and labor not identified, but necessary to complete this Contractors scope of work.

A. Project Phasing site plan is attached at the end of this section 01 01 00

Phase 1 – includes but is not limited to the following work:

1. Demo & identification of underground utilities in the new building footprint. Including demo of an existing electrical ductbank located along the north side of the IB2 building footprint.
2. Over-excavation and construction of the new building.
3. Re-route of existing high voltage electrical service through the site for existing Buildings D, E, F and Q (Cafeteria). Demo of existing high voltage line to those buildings that runs through the IB2 building over ex area.
4. Disconnect existing sewer to the Cafeteria and tie in to a separate sewer line that runs north/south near the building.
5. New Storm Drain connection for the IB 2 site in parking lot G area.
6. Parking Lot G and associated site work modifications near the Child Development Center Building.

Phase 2 – includes but is not limited to the following work:

1. Abatement and demo of Buildings D, E and F.
2. All site work and utilities in Phase 2 area of work.
3. Demo and removal of three large tree stumps between existing Building C and D.
4. Re-establishment of the site in the contractor laydown area indicated on the Laydown Site Map also attached at the end of this section 01 01 00.

B. Site Logistics:

1. Provide a certified survey by a California Licensed Certified Surveyor for all layout prior to actual performance of the work shown in the plans for this project and for As-Built drawings of this project.
2. All construction fencing for this project is included within the base bid and will be laid out to maximize the area per the Phasing and Laydown Plans included at the end of this section 01 01 00. Contractor will have the sole responsibility to include all over excavation requirements for all fencing layout and installation that is part of the project. From time to time throughout the project, this contractor may be required to relocate the temporary fencing to accommodate access to the site for IB 1 construction, Student Service Building construction or District access.

3. All security required for this project will be provided by this contractor and will coordinate with the Campus Police. If necessary, this contractor will hire a full time security guard to protect the site from theft, vandalism, etc.
4. This contractor will have the sole responsibility of ensuring that campus access from Greenleaf is always open for staff and students.
5. This contractor will hire Util-Locate to ensure that all underground utilities are properly identified. See the Construction Manager for the existing Util-Locate map for reference only.
   a. This contractor will identify all utilities to the demolition areas and insure that all utilities are properly capped and safe-off.
   b. Any and all utilities that are found within the work area must be properly identified and capped or rerouted if the utility is needed for the buildings that are to remain occupied.
6. Contractor will ensure that all construction traffic does not impede into the student/staff parking areas. All construction traffic must have flagmen to ensure that there are no disturbances to the campus operations. Early morning deliveries are preferred and/or Friday and Saturdays are better days for delivery and trucks.
7. **This contractor understands that this contract and construction will be conducted under the Occupied Site Protocol. All activities outside of the work area: i.e. Deliveries, Parking, Staging, outside of the designated work area must be scheduled and approved by the District a week prior. This will allow the District ample time to provide a notification to the Students and Staff. Any damage to the District's property outside of the work area will be the contractor's responsibility to repair or replace immediately.**
8. **Utility Safe Off.** This contractor is aware and knows that there are utilities within the over excavation area and will identify, confirm, safe off and/or redirect said utilities so as not to disrupt the district's operations. This will be a mandatory meeting during the mobilization phase of the contract.
9. This contract will be performed at the same time as IB1 and the new Student Services building on campus and it will be the responsibility of this contractor to coordinate with both of the other contractors relating to

personnel, equipment deliveries, and material deliveries to ball locations to ensure no effect to the construction schedules.

C. **DEMOLITION AND ENVIRONMENTAL ABATEMENT**

1. This contractor will comply and provide all Lead and asbestos abatement as specified within the Bainbridge Report provided within the documents and within their base bid. All required certifications will be provided by this contractor on a building by building submittal so as not to affect the progress of the demolition contractor also provided by this contract.

2. This contractor will coordinate and sequence the abatement and demolition contractor to ensure that the demolition is not delayed by the abatement contractor as shown in the schedule within Specification Section Number 01 43 80.

3. This contractor will be responsible and has included within their base bid the demolition of all Concrete Pylons within the over-excavation area for the new building. This demolition will be a minimum of 2 feet below the bottom of the over-excavation area.

4. This contractor will be responsible for providing a Certified As-Built locating the other Concrete Pylons that are exposed after the demolition of the buildings (Buildings D, E and F) that are not within the new building pad location but exposed after the demolition of all required buildings and concrete slabs.

5. Provide all Site Clearing and Selective Demolition and all work pertaining to plans and specification to include the removal of all trees, shrubs and vegetation from the site.

6. All utilities discovered under the demolished buildings will appear on this contractors certified As-Builts for future reference.

D. This contractor will include within their base bid any and all overtime required to make this schedule.

E. Grading and Dirt Management

1. Provide all Earthwork and other related work pertaining to plans and specifications, and soils report.

2. This contractor is aware of the Concrete Pylons within the over excavation area and has included the removal of these Concrete Pylons within the base bid of this contract.

3 All dirt removed and replaced will be managed and remain within the confines of this project and the work area. If there is any dirt that needs to be removed and

temporarily stock piled, the contractor will work with the Construction Manager for an appropriate location on campus.

4. This contractor will have sole responsibility of removing all vegetation from the work area to an offsite location. All clean soil left over from this scope of work will be placed on site at the direction of the construction manager for the District.

F. Provide all Concrete Pavement and all scope of work pertaining to plans and specifications.
G. Provide all Cast-In-Place Concrete scope of work and all related work pertaining to plans and specifications.
H. Provide accurate Vertical and Horizontal Controls.
    1. Establish Bench Mark for Vertical and Horizontal Controls/Coordinate with IB1 benchmarks.
    2. Establish finish elevations for the slab and over excavation requirements throughout the over excavation process.
    3. Monitor and confirm elevations for steel, metal, and masonry installation with progress reports and verification.
    4. Certify exterior rough grade and site work finish grades.
    5. Confirm and certify electrical conduit and cable run to the project electrical service.
    6. Provide certified As-Builts.
I. Insure that all Irrigated areas to remain are tested to provide proper coverage. This contractor will have the sole responsibility to ensure that the areas are reestablished and properly irrigated utilizing the existing controls and timers. This contractor will be responsible for ensuring that all irrigation systems are properly protected in place. Any damage to these irrigation systems will be the sole responsibility of this contractor to reestablish in proper working order. All repairs to the irrigation lines will be with schedule 40 pipe and schedule 80 couplers. This contractor will maintain watering to all trees and grass along the perimeter of construction site.
J. This contractor will provide all underground utilities to include but not be limited to: Electrical Underground Boxes, Pull Boxes, Electrical Service, Trenching, conduits, 6” Red Slurry Mix, Fire, Chiller, Domestic, and irrigation Water and Water connections. Irrigation lines to include Capping, Realign Irrigation, and irrigation controls. Include gas line, sewer line, storm drain, pre-insulated chilled water supply and return lines,

communication, UG pathways and any other UG Utility lines. All displaced soils will be coordinated with the Construction Manager for remaining on site and stockpiled in the proper location.

K. This contractor will conduct weekly meeting with the onsite contractors and any contractors that need to be involved with coordination of upcoming events and/or installations. This contractor will invite the District and Construction Managers to each and every construction weekly meeting. This will also include all special coordination meetings: i.e. Original Lay Out coordination meeting for grading, concrete, utilities, and structural, Rough Opening and backing meetings, an erecting plan and meeting, imbed coordination meeting, Low Voltage coordination meeting, MEP coordination meeting with the Structural Engineer-Architect-Steel contractor, Attic Space coordination meeting, pre-roofing conference with the Roofing Manufacturer representative, all metal cladding backing and installation coordination meetings, etc..

L. This contractor will provide all subcontractor agreements and purchase orders as soon as they are executed and no later than 45 days from the notice of award.

M. **Schedules**

1. This contractor will adhere to Specification Section 01 43 80 for all milestone dates and targets within its schedule submittal.

2. This contractor will ensure that all subcontractors are adhering to the same schedule.

3. To maintain the construction schedule it will be imperative to have the steel contractor break up its submittal to include an early submittal for all steel under finish floor to be submitted early to ensure that the construction schedule is met.

4. This contractor will complete the exterior of the building, less metal cladding, in time to allow sufficient time for the final measurement, manufacturing, delivery, and installation of all the metal cladding within the construction schedule located specification section 01 43 80.

2. **This contractor is to add an allowance of $500,000.00 in their base bid. The allowance shall be listed as a line item in the schedule of values.** The allowance is to be utilized at the discretion of the District through the Construction Manager. The Construction Manager shall be informed of any additional work for validation and for

authorization from the District to use the allowance or portion of the allowance for the work. The Construction manager will document the proposed work, (via the AUR form) which will be performed on a time and material basis, not to exceed if such claim is valid. If this allowance is not exhausted by end of this contractor's contract, a deductive change order will be prepared for any portion of the allowance not used. The allowance shall be listed as a line item on the contractor's schedule of values.

3. **ADD ALTERNATE:** There are no add alternates to this project.

4. Temporary Facilities: This Contractor will have sole responsibility for providing all required temporary services of toilets, water, safety, construction access, and temporary fencing for this contract. These temporary facilities include but are not limited to self-contained toilet units / sanitary facilities, temporary roads and paved areas, maintaining fire lane access at all times during construction, facilities for dewatering (from any source of water) and drains, project identification and temporary construction signage, trash disposal facilities, environmental protection, storm water control, tree and plant protection, pest control, barricades**,** traffic control flagman/flagmen with phone/radio, (daily at all points of delivery and/or exiting of materials, waste etc. as required), security, warning signs and lights, temporary enclosures, temporary partitions, temporary fire protection and fire extinguishers.

5. The following is additional information, instructions and detailed requirements for this Contractors scope of work as identified.

   a. Provide all shop drawings and submittals so as to not cause any delays to any portion of the construction schedule and in compliance with Specification Section 01 43 80. All delays for not complying with the procurement schedule will be referred to delay claims by the District to the Contractor per the general conditions.

      This Contractor is to adhere to the following submittal schedule shown as Calendar Days.

1. Executed contract.	Ten (10) Days from the District's issuance of a Notice to Proceed.
2. Submittal	Twenty Five (25) Days from the District's issuance of a Notice to Proceed
3. Shop Drawing Schedule	Forty Five (45) Days from the District's issuance of a Notice to Proceed
4. Procurement schedule with all copies of purchase orders and subcontractor agreements.	Twenty Five (25) Days from the District's issuance of a Notice to Proceed
5. Manufacturing schedule with all long lead and special inspection requirements.	Forty Five (45) Days from the District's issuance of a Notice to Proceed
6. Delivery schedule.	Forty Five (45) Days from the District's issuance of a Notice to Proceed
7. Detailed construction schedule.	Fifteen (15) Days from the District's issuance of a Notice to Proceed
8. Commissioning, Warranty, Closeout and punch list schedule.	Thirty Five (35) Days from the District's issuance of a Notice to Proceed.

b. This Contractor is responsible for all barricades, or other types of protection necessary to prevent damage to existing improvements indicated to remain. This contractor is to ensure that the site is secured at all times by usage of barricades, fencing & gates w/locks, and any other means required on a daily basis to prevent entrance by unauthorized personnel. This Contractor is also responsible for providing daily cleanup, street cleaning, and dust control surrounding the area of work affected by the construction activities for this project. Maintain and/or rework fencing, barricades, and paths of travel on a daily basis and/or as described in Division 01, Section 01 50 00, Temporary Facilities and Controls or as directed by the Construction Manager.

c. This Contractor will immediately, after award of contract, set up a meeting with the Districts Facilities Department

to review the entire irrigation layout around the scope of work for this contract. Insure protection of existing site concrete flatwork, curb and gutter, sidewalks, benches, railings, pathways, landscaping, irrigation, planting areas, trees, breaking or skinning of roots, skinning and bruising of bark, smothering of trees, shrubs, and ground cover. No stockpiling of construction materials or excavated materials within planters and landscaped areas. No excess foot or vehicular traffic, or parking of vehicles within planters and landscaped areas during the demolition and construction stage of this project through to project acceptance by the owner. Any damage to the above is to be corrected / repaired by this Contractor at no additional cost to the District. Any repairs will be like for like.

d. This Contractor is to inspect all materials delivered to the site for damage. Store materials on site in enclosures or under protective covering out of direct sunlight. Do not store materials directly on ground. Keep inside of pipes and fittings free of dirt and debris.

e. Storm drains shall be staked by a Land Surveyor licensed to practice in the state of California.

f. Provide adequate cribbing, sheathing, and shoring as necessary to safely retain the earth sides of excavations and trenches from caving and other damage resulting from excavating, together with suitable forms of protection against property damage and bodily injury to personnel employed on the work and the general public. Contractor to be responsible for the design, installation, and maintenance of required cribbing and shoring, and shall meet the approval of the Cal/OSHA and local governing agency requirements.

g. Drain lines, including trenches, shall be protected from damage during the entire construction period. This Contractor is responsible to replace or rework damaged portion of the work at no cost to the Owner.

h. Provide all dust, wind erosion control and street cleaning through out the entire duration of this project and for this Contractors scope of work.

i. Provide all labor, material, equipment for the installation, per the plans and specification sections.

j. All costs for repairs due to this Contractor's negligence shall be borne by this Contractor without impact to the approved construction schedule and without additional cost to the District.

k. Continuous site cleanup, which includes street cleaning of perimeter road, parking lot and sidewalks, sweeping, litter removal, and housekeeping and daily cleanup of site is mandatory. This Contractor shall put debris in its own debris boxes and/or remove debris from site at this contractor's own expense prior to the end of the work day or as directed by the Construction Manager. All debris boxes and containers shall be kept free of graffiti at all times. If this Contractor fails to perform daily clean up, the Construction Manager upon written notice to the Contractor shall order that clean up done at this Contractor's expense and adjust Contractors contract accordingly.

l. This Contractor is to provide all white glove clean up scope of work for the surrounding site for the entire project, including but not necessarily limited to removal of all residual trash created during this contractor's scope of work. Cleaning up must have the Districts final approval through the Construction Manager.

m. This Contractor shall coordinate his work with that of other District contractors, subcontractors and work by the District as necessary. All potential space conflicts are to be identified during the bidding and field investigation process. If a field space conflict is encountered, it shall be reworked or rerouted at no additional cost, and only a scope change by the Architect will be considered for contract price adjustment.

n. Revisions/Updating Contract Documents - This Contractor is responsible to immediately update all field and office sets of contract documents upon receipt of any revised instructions. This includes addenda, revised drawings, "RFI" responses, bulletins, etc. This Contractor shall insert, "cut and paste", revise with red ink or other suitable methods denoting the most current construction

documents. **Payments to the contractor shall be withheld until drawings are updated.**

o. Record Drawings - This Contractor shall maintain and update all changes in the work on the Contractor's record drawing set in the field office. All entries must be made and reviewed by the Construction Manager and Project Inspector. **Monthly progress payments will not be paid until this requirement is complied with.** If applicable, this Contractor shall use the contract specifications as a minimum guideline standard. This Contractor shall pay the cost for the final issue of reproducible record drawings, three (3) each that are required by this scope of work.

p. Deviation From Design - This Contractor shall NOT deviate from the design required by the contract documents unless the design violates code requirements or the design is unfeasible. If a design condition warrants a change, then this Contractor shall issue a "Request for Information" pursuant to the terms of the Request for Information article in this exhibit; prior to the work being performed so as to not delay work.

q. Contractor Personnel - The District has complete authority to review and approve selection of this Contractor's field and office personnel for this project. The District has authority to request replacement of any Contractor personnel for reasons determined by the District. This Contractor shall maintain the same approved personnel throughout the entire duration of the project at the District's discretion. This Contractor will, at the time of award of work, furnish a list of persons assigned to the Project showing their titles and telephone numbers. Emergency telephone numbers shall also be provided for the after hour use by the District.

r. This Contractor agrees to provide a minimum of one competent English speaking skilled foreman or superintendent who shall be present at all times during execution of this Contractor's work. Failure to provide adequate Project Management or Superintending shall result in an assessment of Construction Management costs levied to have the Construction Manager coordinate and manage contractors / subcontractor's work. In no event shall Construction Manager be liable

for any costs associated with this Contractors lack of supervision. This Contractor agrees to use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work.

s. Provide timely requests for clarifications and other information to allow reasonable response time and avoid delay to the construction schedule.

t. Provide all hoisting necessary for this Contractors entire scope of work.

u. Schedule shall be in accordance with District approved construction milestone schedule provided in Section 01 43 80 and all subsequent revisions.

v. This contractor is to address punch list, final clean up, and closeout, per the contract construction schedule and or the District's desire for occupancy. This contractor agrees that delays to completion of punch list and closeout would constitute a delay in project completion and therefore this contractor shall be subject to the assessment of liquidated damages per the Contract Documents.

w. Existing Site Conditions: This Contractor shall make a thorough examination of the site to determine all existing conditions affecting the work prior to beginning any work under this Contractor. All conflicts within the contract documents and existing conditions are to be brought to the attention of the Construction Manager during the bidding process by way of the pre-bid clarification form issued at the job walk. Any claims for changes in scope or claims for additional compensation will not be considered for this contractor's failure to notify the Construction Manager of such a conflict/discrepancy.

x. Location of Site:

Compton Community College District
1111 E. Artesia Blvd.
Compton, CA. 90221

1.3 CONTRACT METHOD:

A. Construct the Work under a single Lump Sum Contract with a Schedule of Values identifying all scope of work.

1.4 CONTRACTOR USE OF PREMISES:

A. Contractor shall have use of the premises for the execution of the work. **This contractor understands that this contract and construction will be conducted under the Occupied Site Protocol. All activities outside of the work area: i.e. Deliveries, Parking, Staging, outside of the designated work area must be scheduled and approved by the District a week prior. This will allow the District ample time to provide a notification to the Students and Staff. Any damage to the District's property outside of the work area will be the contractor's responsibility to repair or replace immediately.**

B. Work Week and Job Hours - Work hours are subject to standard construction hours per the Ordinance set by the City of Compton, Ca. Contractor is expected to work weekends and holidays, as necessary, to complete the work within the specified time of completion without any additional cost to the District. If the contractor plans to work off hours and/or weekends at times during the course of the project, this contractor needs to notify the Construction Manager (PCM3) forty eight (48) in advance. All weekends, holidays, or irregular hours worked must be supervised by the Construction Manager and be in compliance with local ordinances. Coordinate use of the premises under the direction of the Construction Manager.

C. This Contractor shall enforce that all persons working on the site use only non-permanent markers, tapes and tags to indicate construction techniques and instructions, on construction in progress, and on existing construction. This includes markings on exterior and interior of building and on walks, curbs, walls and other site surfaces. Where work is damaged or defaced by use of permanent marking devices, such work will be subject to cleaning, repair or replacement, as the Architect may require.

D. Move any stored products under This Contractor's control that interferes with the operations of the Owner and/or any other Contractor that is on a separate contract.

E. Obtain and pay for the use of additional storage or work areas needed for operations.

F. This Contractor shall assume all responsibility for parking his own and his subcontractor's vehicles at the direction of the Construction Manager. Contractor shall direct all material deliveries to the construction gate.

G. Theft: If any person working on the contract should engage in theft of money, property, supplies, equipment, food, or any other item, whether from the District's personnel, students, facilities, employees, visitors, or from another of the Contractor's personnel or subcontractors, will be immediately and permanently dismissed from the site.

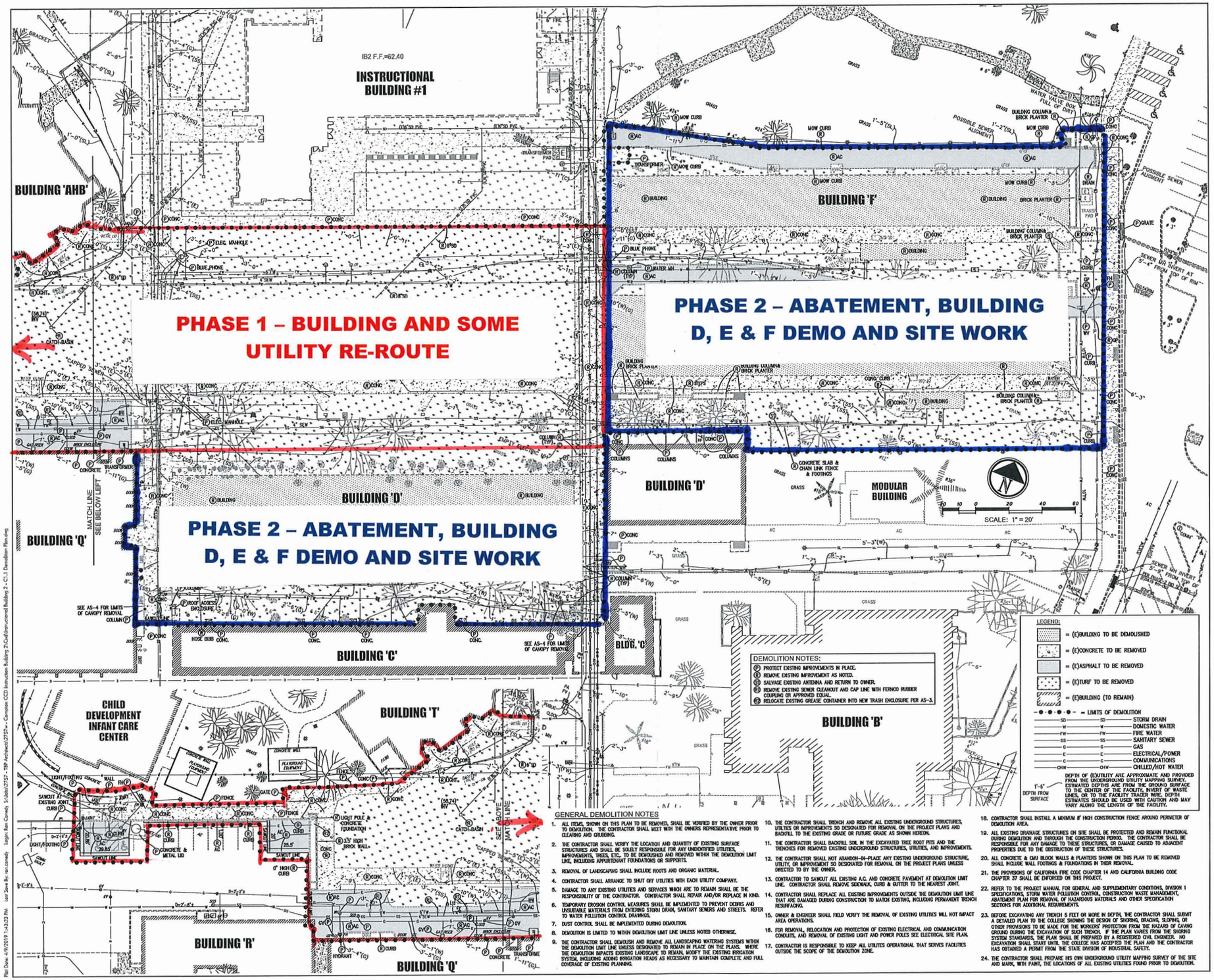
H. All District property is smoke free, drug free, alcohol free, weapons free and graffiti free. This Contractor shall enforce these rules with his crew, subcontractors and suppliers.

I. All contractors must comply with the District's policies regarding worker conduct and security, including fingerprinting and badging requirements as per the “Agreement for Compliance with education Code 45125.1”

J. **SWPPP/Erosion Control**: This Contractor shall install and comply with the Erosion Control Measures/Storm Water Pollution Prevention Plan in accordance with all local and state agency standards and as identified in the contract documents regarding erosion control. The Contractor shall be responsible for installing all erosion control features and maintaining in a good condition for the duration of the project, as deemed reasonable by local and state agency standards until the project is completed. This Contractor shall provide and maintain at all times during construction all necessary pumping and other devices with which to promptly remove and properly dispose of all water from rainfall run-off entering the excavations or other parts of the work. Erosion control devices shall not be removed or modified without the written approval of the Engineer. After a rainstorm, trenching, directional boring etc., all silt and debris shall be removed from check berms and desilting basins. Any erosion protection measures damaged during a rainstorm shall be immediately repaired. Any drainage ditch or earthen walled storm drain channels that are adjacent to a pipeline trench or within the limits of the work if damaged or altered shall be reshaped to the satisfaction of the Owner. If erosion control problems occur, this Contractor shall correct the condition immediately and prior to receiving a correction notice from the Owner. If a notice is issued and the erosion problem is not corrected, the Owner will proceed to have the defects repaired, and all costs incurred will be deducted from the Contractor's progress payments

All costs for the requirements in this section shall be included in the contract unit or lump sum prices for such work appurtenant thereto, and no additional allowance will be made therefore. One half of the cost of the erosion control work will be withheld until after all erosion control features are removed and all affected areas are cleaned and restored.

END OF SECTION



IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP. 03-119458 INC:
REVIEWED FOR
SS ☑ FLS ☑ ACS ☑
DATE: 05/23/2019

DIVISION OF STATE ARCHITECT
355 South Grand Avenue, Suite 2100
Los Angeles, California, 90012
ph: (213) 897-3995 Fax: (213) 897-3159
agency

tBP architecture planning interiors
tBP/Architecture
4611 Teller Avenue
Newport Beach, CA 92660
ph: 949.673.0300 fx: 949.732.3895
architect

FPL and Associates, Inc.
Traffic - Transportation - Civil
30 Corporate Park, Suite 401
Irvine, CA 92606
(949) 252-1668
consultant

COMPTON COLLEGE
INSTRUCTIONAL BUILDING No. 2
COMPTON COMMUNITY COLLEGE DISTRICT
1111 E. ARTESIA BLVD. COMPTON, CA.

owner

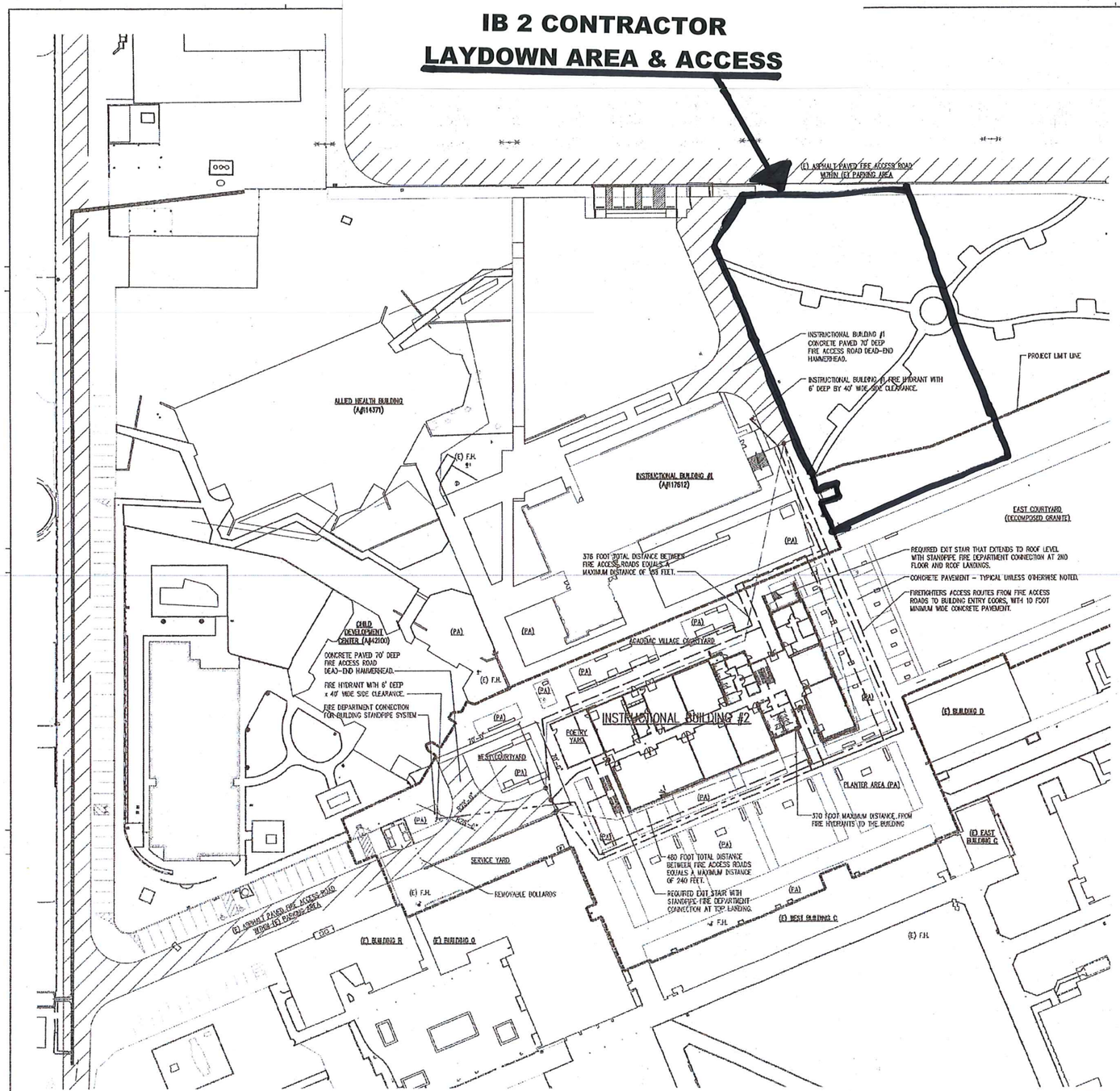
IBP project number : 20998.00
file name:
drawn by: checked by:
date: 04/08/2019

Rev:	date:	description:

drawing title:
DEMOLITION PLAN

drawing no.:
C1.1
drawing of

IB 2 CONTRACTOR
LAYDOWN AREA & ACCESS



FIRE ACCESS SITE PLAN

SCALE: 1"=30'

FIRE ACCESS AND HYDRANTS

EXISTING AND NEW 20 FOOT WIDE FIRE DEPARTMENT VEHICULAR ACCESS ROADS WITH 13'-6" MINIMUM UNOBSTRUCTED VERTICAL CLEARANCE PER CFC SECTION 503.2.1.

EXISTING OR NEW FIRE WATER HYDRANTS

CODE AND BUILDING DESCRIPTION

LOCAL FIRE AUTHORITY: CITY OF COMPTON FIRE DEPARTMENT
COVERING AUTHORITY: CALIFORNIA DIVISION OF THE STATE ARCHITECT
GOVERNING CODE: 2016 CALIFORNIA FIRE CODE INCLUDING APPENDICES BB, CC, AND N.

BUILDING DESCRIPTION
AREA: 33,200 SF
CONSTRUCTION TYPE: I-B
HEIGHT: 2-STORY AT 35'-0" HIGH
FIRE PROTECTION: CFC SPRINKLER SYSTEM PER NFPA 13 AND 2016 CBC.
CFC STANDPIPE SYSTEM PER NFPA 14 AND 2016 CBC.
FIRE ALARM: CFC ALARM SYSTEM PER NFPA 72 AND 2016 CBC & CEC.
USE: CLASSROOMS, MEETING ROOMS, AND OFFICES (GROUP A & B OCCUPANCIES)

FIRE FLOW ANALYSIS

MINIMUM REQUIRED FIRE FLOW AND DURATION FOR SCHOOL BUILDINGS – CFC TABLE B3 105.1

CONSTRUCTION TYPE	FIRE AREA	FIRE FLOW	REQUIRED FIRE FLOW AFTER 75% REDUCTION FOR BUILDING BEING SPRINKLERED	FLOW DURATION
I-B	33,200 SF	3,700 GPM	1,000 GPM	3 HOURS

NUMBER AND DISTRIBUTION OF FIRE HYDRANTS FOR SCHOOL BUILDINGS – CFC TABLE C105.1

FIRE FLOW REQUIREMENT	MINIMUM NUMBER OF REQUIRED FIRE HYDRANTS	MAXIMUM DISTANCE FROM ANY POINT ON FIRE ACCESS ROAD TO REQUIRED FIRE HYDRANT		
		REQUIRED MAXIMUM DISTANCE	50 FOOT REDUCTION FOR DEAD-END FIRE ACCESS ROAD	MAXIMUM DISTANCE PROVIDED
1,000 GPM	1	250 FEET	200 FEET	LESS THAN 50 FEET

NOTE: AN AVAILABLE FIRE FLOW OF 4,654 GPM @20 PSI WAS RECORDED IN THE MAY 8, 2018 FLOW TEST CONDUCTED BY THE CITY OF COMPTON WATER UTILITY DIVISION.

FIRE ACCESS ROADS ANALYSIS

LOCATION OF FIRE ACCESS ROADS – CFC SECTION 503.1.1

MAXIMUM DISTANCE FROM A FIRE ACCESS ROAD TO ALL PORTIONS OF THE PROPOSED BUILDING	
PER SECTION 503.1.1	INCREASE IN DISTANCE AS ALLOWED PER CFC 503.1.1, EXCEPTION 1 FOR SPRINKLERED BUILDING
150 FEET	240 FEET AS INDICATED ON SITE PLAN

LOCATION OF FIRE HYDRANTS – CFC SECTION 507.5.1

MAXIMUM DISTANCE FROM FIRE HYDRANTS OR FIRE ACCESS ROADS TO ALL PORTIONS OF THE PROPOSED BUILDING	
PER SECTION 507.5.1	MAXIMUM DISTANCE AS INDICATED ON SITE PLAN
400 FEET	370 FEET

FIRE ACCESS ROADS SHALL COMPLY WITH CFC CHAPTER 5 AND APPENDIX D AS FOLLOWS
- 20 FOOT WIDTH PER SECTION 503.2.1.
- 6 FOOT DEEP x 40 FOOT LONG CLEARANCE AT FIRE HYDRANTS PER FIGURE D103.1.
- HEAD-END HAMMERHEAD WITH 20 FOOT WIDE ROAD PER TABLE D103-4 AND FIGURE D103.1.

FIRE ACCESS NOTES

1. THE FIRE DEPARTMENT ACCESS SIGNAGE SHALL BE INSTALLED PRIOR TO COMMENCING THE NEW CONSTRUCTION WORK TO FACILITATE FIRE DEPARTMENT ACCESS DURING CONSTRUCTION. THIS SIGNAGE SHALL ALSO REMAIN IN PLACE UPON COMPLETION OF CONSTRUCTION AND SHALL BE UPDATED AS NEEDED TO FACILITATE FIRE DEPARTMENT ACCESS.
2. FIRE APPARATUS ACCESS ROADS AND WATER SUPPLY FOR FIRE PROTECTION SHALL BE INSTALLED AND MADE SERVICEABLE PRIOR TO AND DURING THE TIME OF CONSTRUCTION EXCEPT WHEN APPROVED ALTERNATIVE METHODS OF PROTECTION ARE PROVIDED. (CFC SECTION 501.4)
3. FIRE DEPARTMENT VEHICULAR ACCESS ROADS MUST BE INSTALLED AND MAINTAINED IN A SERVICEABLE MANNER PRIOR TO AND DURING THE TIME OF CONSTRUCTION. (CFC SECTION 501.4)
4. FIRE DEPARTMENT VEHICULAR ACCESS ROADS SHALL BE HARDSURFACES AND MAINTAINED TO PROVIDE ACCESS BY FIRE APPARATUS AT ALL TIMES. (CFC SECTION 503.2.3)

DSA 810
LOCAL FIRE AUTHORITY REVIEW

To facilitate the Division of the State Architect's (DSA) review of the first plan check portion of a project, DSA requires Local Fire Authority (LFA) review of various elements as identified in this form. Use of this form is mandatory for projects that add square footage to a campus or if any item on this form is relevant to the project. For additional information, see DSA PR 13-01 Instructions and DSA Policy 2013-1.

PROJECT INFORMATION
School District/Owner: Compton Community College District
Project Name/School: Compton College
Project Address: 1111 E. Artesia Blvd. California 90221

LOCAL FIRE AUTHORITY REVIEW
LFA Agency Name: Compton Fire Department
LFA Reviewer Name: Kenneth L. Simpson Title: FIRE CHIEF Telephone Number: (310) 605-5611
Email:
I have reviewed and responded to the applicable items for this project and listed below.
Note: Only sign this form when it is ready for submittal to DSA.
LFA Reviewer's Signature: [signature] Date: 10/2018
Review Key: "YES" = Complies with LFA requirements. "NO" = Not approved (complete Section 8). "N/A" = Not applicable to the project. "INFO" = LFA advises, not to review.

	Description	YES	NO	N/A
1	Where an elevator does not meet medical emergency service size, size per the California Building Code (CBC), use of stairways for emergency rescue and patient carry may be permissible.			X
2	Access roads, fire lane markings, severe and gate entrances are in accordance with Title 19 California Code of Regulations and the California Fire Code, Chapter 5.	X		
3	Fire hydrant location and distribution complies with the California Fire Code (or see # 4).			X
4	Fire hydrant location and distribution complies with NFPA 1142, "Alternate Means." If "NO" is checked, DSA normally approves only the water storage as an alternate. The signature of the school district official is required to acknowledge the use of alternate means.			X
	Signature of School District Official: _____ Date: _____			
	From the School District Official's Home:			
5	The location(s) of the proposed post indicator valve and fire department connection meet the requirements of this jurisdiction.	X		
6	The location(s) of the exterior shut valve assembly meet the requirements of this jurisdiction.	X		
7	Is the project located in a hazard severity zone? (CBC, Chapter 7A, Section 701A.) ☐ Yes ☒ No Check type of "risk": ☐ Moderate ☐ High ☐ Very High ☐ N/A (If one of these boxes is checked, the project design must meet the requirements of Chapter 7A.)			
8	COMMENTS (Use attachments if necessary)			

DSA 810 (New 09/14) — Page 1 of 1
DIVISION OF THE STATE ARCHITECT — DEPARTMENT OF GENERAL SERVICES — STATE OF CALIFORNIA

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP. 03-119458 INC:
REVIEWED FOR
SS ☑ FLS ☑ ACS ☑
DATE: 05/23/2019

DIVISION OF THE STATE ARCHITECT
355 South Grand Avenue, Suite 2100
Los Angeles, CA 90012
ph: (213) 897-3995 fx: (213) 897-3159
agency

tBP architecture
4201 Architecture
4201 Birch Avenue
Newport Beach, CA 92660
ph: 949.673.0300 fx: 949.752.3895
architect

City of Compton
Fire Department
APPROVED
[signature] DATE: 8/24/18
FIRE PREVENTION BUREAU
(X) Subject to field inspection approval
( ) Subject to corrections on plans
( ) Subject to compliance/sheet requirement
( ) Conceptual approval only
agency

COMPTON COLLEGE
INSTRUCTIONAL BUILDING No. 2
COMPTON COMMUNITY COLLEGE DISTRICT
1111 E. ARTESIA BLVD. COMPTON, CA.
owner

IBF project number: 20698.00
file name:
drawn by: checked by
date: 08/14/18
Rev: date: description:

drawing title:
FIRE ACCESS SITE PLAN
drawing no:
T-4
drawing of

COMPTON COMMUNITY COLLEGE DISTRICT

ALLOWANCES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Allowances which the Contractor shall provide for designated construction activities in the Work and in this bid.

B. The provisions in this Section only apply if the Owner includes Allowances in the Contract.

1.2 RELATED DOCUMENTS

A. The Conditions of the Contract and other section of Division 01 apply to this section as fully as if repeated herein, including Section 01 01 00 – Scope of Work.

1.3 DESCRIPTION OF REQUIREMENTS

A. Definitions and Explanations: Certain requirements of the construction related to each allowance are indicated and specified. The Allowance has been established by the Owner and represents selection by the Owner of selected Sub-Contractors for designated portions of the work specified and shown.

B. Types of allowance scheduled herein for the Work include lump sum cash allowances. Include all allowances in Contract sum, and identify all allowances in Schedule of Values as separate line items.

C. Selection and Purchase: At earliest feasible date after award of contract, advise the Architect/Engineer of scheduled date when final selection and purchase of each product or system described by each allowance must be accomplished in order to avoid delays in performance of the Work.

1. Establish date by which Prime Contractor must enter into contract and coordinate with sub-contractor responsible for work defined by allowance.

2. Establish date by which final list of products must be established for purchase of products and systems as specifically selected by the District.

1.4 DEFINITIONS AND DESCRIPTION OF REQUIREMENTS

A. Cash Allowance Criteria

1. The Allowance is used only as directed by the Owner.

2. The Allowance is used exclusively for the Owner's purposes and for scope(s) of work as directed by Owner.

3. The sub-contractor will prepare detailed breakdown of all costs associated with the work defined for the Allowance. These amounts will be charged against the Allowance by Change Order, based on final detailed payment receipts and back-up as required by Architect/Engineer, and will include all costs of work performed under the defined work scope.

    a. If required by Owner, Contractor shall obtain quotes for equipment from three separate vendors and present to District for consideration and selection.

4. Contractor shall include in the base bid contract amount all cost of coordination, supervision, bond costs, overhead and profit, supervision, installation and all indirect project costs associated with performing the work of each Allowance. Contractor shall be permitted to charge only its direct costs to perform the work, as indicated through documentation approved by the District.

    a. At project closeout, any unused Cash Allowance amounts shall be credited to the Owner by Change Order. Contractor shall not deduct costs such as bond costs, overhead and profit or other indirect costs when returning any unused Cash Allowance amounts.

    b. Changes that exceed the scope of work or amount of each Allowance covered by each allowance will be processed as a Change Order per Contract Documents.

PART 2 – PRODUCTS - (Not Applicable)

PART 3 – EXECUTION

3.1 SCHEDULE OF CASH ALLOWANCES

COMPTON COMMUNITY COLLEGE DISTRICT

1. **This Contractor will provide a $500,000 Allowance which is to be included in the base bid. This allowance is to be used at the District's discretion.**

This page intentionally left blank.

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Requirements:

1. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
2. Section 014000 "Quality Requirements" for field testing by an independent testing agency.

1.3 DEFINITIONS

A. Unit price is an amount incorporated into the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Price 1: Installation of nonrated semirecessed fire extinguisher cabinets.

1. Description: Install nonrated semirecessed fire extinguisher cabinets, as directed by authorities having jurisdiction, in accordance with Section 104413 "Fire Extinguisher Cabinets."
2. Unit of Measurement: Installed nonrated semirecessed fire extinguisher cabinet, based upon survey of completed installation.

B. Unit Price 2: Installation of fire rated semirecessed fire extinguisher cabinets.

1. Description: Install fire rated semirecessed fire extinguisher cabinets, as directed by authorities having jurisdiction, in accordance with Section 104413 "Fire Extinguisher Cabinets."
2. Unit of Measurement: Installed fire rated semirecessed fire extinguisher cabinet, based upon survey of completed installation.

C. Unit Price No. 3: Installation of fire extinguishers.

1. Description: Install fire extinguishers, as directed by authorities having jurisdiction, in accordance with Section 104416 "Fire Extinguishers."
2. Unit of Measurement: Installed fire extinguisher, based upon survey of completed installation.

END OF SECTION 012200

COMPTON COMMUNITY COLLEGE DISTRICT

ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for Alternates.

B. Definition: An Alternate or Alternate Bid is an amount proposed by Bidders and stated on the Bid Form for certain construction activities defined in the Bidding Requirements that may be added to or deducted from Base Bid amount if the School District decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems or installation methods described in Contract Documents.

C. Coordination: Coordinate related Work and modify or adjust adjacent Work as necessary to ensure that Work affected by each accepted Alternate is complete and fully integrated into the project.

D. Notification: Immediately following the award of the Contract, prepare and distribute to each party involved, notification of the status of each Alternate. Indicate whether Alternates have been accepted, rejected or deferred for consideration at a later date. Include a complete description of negotiated modifications to Alternates.

E. A "Schedule of Alternates" is included as an attachment at the end of this section.

1. Include as part of each Alternate, miscellaneous devices, accessory objects and similar items incidental to or required for a complete installation whether or not mentioned as part of the Alternate.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

B. Bid Form

PART 2 – PRODUCTS - (Not Applicable)

PART 3 - EXECUTION

COMPTON COMMUNITY COLLEGE DISTRICT

3.1 SCHEDULE OF ALTERNATES

1. There are no alternates on this bid.

END OF SECTION

COMPTON COMMUNITY COLLEGE DISTRICT

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for making modifications to the contract including:

1. Change Orders/Allowance Usage

2. Construction Change Documents (see General Conditions)

3. Contract Credits

4. Contract Additions

5. Construction Change Directives

6. Emergency Change Directives (see General Conditions)

7. Instructions

B. Modifications:

1. Provide full written data required to evaluate contract modifications, including breakdown of labor, material, equipment and description of work with unit costs for each category.

2. Maintain detailed records of work done on a time-and-material basis.

3. Provide full documentation for all proposed Change Orders to the Architect for his review.

C. Designate in writing the member of Contractor's organization:

1. Who is authorized to accept changes in the Work.

2. Who is responsible for informing others in the Contractor's employ of the authorization of changes in the Work.

1.2 RELATED SECTIONS

A. Addenda: All issued Addendums

B. Agreement: The amounts of unit prices if any as established in the Contract.

C. General Conditions Article 9, Changes in the Work.

D. Section 01 33 00 - Submittals

E. Section 01 63 00 - Product Substitution Procedures

1.3 REFERENCES

A. Change Order Requirements per Title 24 Part 1 CCR.

1. Changes in the plans and specifications are to be made by addenda or Change Orders or construction change documents approved by the Division of the State Architect, Title 24 Part 1 Section 4-338.

2. Change Orders: Changes or alterations of the approved plans or specifications after a contract for the work has been awarded are to be made by means of Change Orders. State the reason for the change and provide supplementary drawings where necessary. Change Orders must be manually signed by the Architect or Engineer in general responsible charge of observation of the work or by the Architect or Engineer delegated responsibility for observation of the portion of the work affected by the Change Order.

3. Change Orders are required to bear the approval of the School Board or their authorized representative upon delegated authority.

4. One original signed copy by all parties of each Change Order is required for the files of the Division of the State Architect.

1.4 PRELIMINARY PROCEDURES

A. The Architect or School District may initiate changes by submitting a Request For Quotation. The request will include:

1. Detailed description of the Change, Products, and location of the change in the Project. Changes may include additions and deletions from the Contract.

2. Supplementary or revised Drawings and Specifications.

3. The projected time span for making the change and a specific statement as to whether overtime work is, or is not, authorized.

4. A specific period of time during which the requested price will be considered valid.

5. Such request is for information only, and is not an instruction to execute the changes, nor to stop Work in progress.

B. Contractor may initiate changes by submitting a written Allowance Usage Request or Proposed Change Order Request to the Architect or School District containing:

1. Description of the proposed change.

2. Statement of the reason for making the changes.

3. Statement of the effect on the Contract Sum/ Contract Price and the Contract Time.

4. Statement of the effect on the Work of separate contractors with breakdown of costs for labor, materials and equipment.

5. Documentation supporting any change in Contract Sum/ Contract Price or Contract Time, as appropriate.

1.5 CONSTRUCTION CHANGE DIRECTIVES

A. In lieu of Proposal Request, the School District through the Construction Manager may issue, a Construction Change Directive (also referred to as an Immediate Change Directive in the General Conditions) for Contractor to proceed with a change which shall state a basis for adjustment, if any, in the Contract Sum/ Contract Price or Contract Time, or both.

B. Authorization will describe changes in the Work, both additions and deletions, with attachments of revised Contract Documents to define details of the change, and will designate the method of determining

any change in the Contract Sum/ Contract Price and any change in Contract Time.

C. The School District and Architect will sign and date the Construction Change Directive as authorization for the Contractor to proceed with the changes.

D. Contractor may sign and date the Construction Change Directive to indicate agreement with the terms therein.

1.6 DOCUMENTATION OF PROPOSALS AND CLAIMS

A. Support each quotation for a lump-sum proposal, and for each unit price which has not previously been established, with sufficient substantiating data to allow the Architect/Engineer and School District to evaluate the quotation.

B. On request provide additional data to support time and cost computations:

1. Labor required in hours with unit costs.

2. Equipment required.

3. Products required in units.

a. Recommended source of purchase and unit cost.

b. Quantities required.

4. Taxes, insurance and bonds.

5. Credit for Work deleted from Contract, similarly documented.

6. Overhead and profit.

7. Justification for any change in Contract Time.

C. Support each claim for additional costs, and for work done on a time and material basis, with documentation as required for a lump-sum proposal, plus additional information:

1. Name of the School District's authorized agent who ordered the work, and date of the order.

2. Dates and times work was performed, and by whom.

3. Time record, summary of hours worked, and hourly rates paid.

4. Receipts and invoices for:

   a. Equipment used, listing dates and times of use.

   b. Products used, listing of quantities.

   c. Subcontracts.

D. Document requests for Substitution of Products as specified in Section 01 63 00.

1.7 CONSTRUCTION CREDITS

A. Work deleted and no work has been completed by the Contractor: Work deleted from the contract is to be credited back to the District and subtracted from the contract amount. Credits are to be included in Change Orders.

1. Contractor shall credit back to the District total value for the work deleted from the contract. Cost of credits shall be determined by the amount stated in the Contractor's Schedule of Values.

2. Where the value of credits cannot be determined from the Contractor's Schedule of values, total value of the credit is to be determined by the cost of materials, labor, overhead and profit, insurance, bonds, etc. All General Contractor, Subcontractor and Material Supplier levels of the Contract are to be included in the total value of credits back.

3. No amount at any level of the contract shall be withheld from credits for overhead and profit, insurance, bonds, time delays, construction schedule changes and administrative expenses.

B. Work deleted and a portion of the work has been completed by the Contractor: Work deleted from the contract is to be credited back to the District and subtracted from the contract amount. Credits are to be included in Change Orders.

1. Contractor shall credit back to the District the total value of the work deleted from the contract less any work already completed on the credit item. Cost of credits shall be

determined by the amount stated in the Contractor's Schedule of Values less any work already completed. Completed work may include cost of shop drawings, submittals, site preparation, partially completed work on the credit item or other expenses related to the item.

2. Where the value of credits cannot be determined from the Contractor's Schedule of values, total value of the credit is to be determined by the cost of materials, labor, overhead and profit, insurance, bonds, etc. All General Contractor, Subcontractor and Material Supplier levels of the Contract are to be included in the total value of credits back.

3. An amount equal to the percentage of work already completed on the deleted item may be withheld from credits back for overhead and profit, insurance, bonds, construction schedule adjustments and administrative expenses, as indicated in the General Conditions (Section 00700).

1.8 PREPARATION OF CHANGE ORDERS

A. The Architect or Construction Manager will prepare each Change Order.

B. Change Order will describe changes in the Work, both additions and deletions, with attachments of revised Contract Documents to define details of the change.

C. Change Order will provide an accounting of the adjustment in the Contract Sum/ Contract Price and in the Contract Time.

1.9 LUMP-SUM/FIXED PRICE CHANGE ORDER

A. Content of Change Orders will be based on either:

1. The School District's Proposal Request and Contractor's responsive Proposal as mutually agreed with the School District.

2. Contractor's Proposal for a change, as recommended by the School District or their authorized agent.

B. The School District, Division of the State Architect and Architect or Engineer in responsible charge will sign and date the Change Order as an authorization for the Contractor to proceed with the changes.

C. The Contractor will sign and date the Change Order to indicate agreement with the terms therein.

1.10 UNIT PRICE CHANGE ORDER

A. Content of Change Orders will be based on either:

1. The School District's definition of the scope of the required changes.

2. Contractor's Proposal for a change, as recommended by the School District or Authorized Agent.

3. Survey of completed work.

B. The amounts of the unit prices to be:

1. Those stated in the Agreement.

2. Those mutually agreed upon between School District and Contractor.

C. When quantities of each of the items affected by the Change Order can be determined prior to start of the work:

1. The School District and Architect or Engineer in responsible charge will sign and date the Change Order as authorization for Contractor to proceed with the changes.

2. Contractor is to sign and date the Change Order to indicate agreement with the terms therein.

D. When quantities of the items cannot be determined prior to start of the work:

1. The School District through the Architect will issue a Construction Change Directive directing the Contractor to proceed with the change on the basis of unit prices, and will cite the applicable unit prices.

2. At completion of the change, the School District or its authorized agent will determine the cost of such work based on the unit prices and quantities used.

3. The Contractor shall submit documentation to establish the number of units of each item and any claims for a change in Contract Time.

4. The School District, Division of the State Architect and Architect or Engineer in responsible charge will sign and date the Change Order as authorization for the Contractor to proceed with the Changes.

5. The Contractor will sign and date the Change Order to indicate agreement with the terms therein.

1.11 TIME AND MATERIALS CHANGE ORDER/CONSTRUCTION CHANGE DIRECTIVE:

A. The School District through the Architect will issue a Construction Change Directive directing Contractor to proceed with the changes

B. At completion of the change, Contractor shall submit itemized accounting and supporting data as provided in the Article 1.6, "Documentation of Proposals and Claims," of this Section.

C. The School District or its authorized representative will determine the allowable cost of such work, as provided in General Conditions and Supplementary Conditions.

D. The School District, Division of the State Architect and Architect or Engineer in general responsible charge will sign and date the Change Order to authorize the change in Contract Sum/ Contract Price and in Contract Time.

E. The Contractor will sign and date the Change Order to indicate agreement with the terms therewith.

1.12 INSTRUCTIONS

A. Architect's Supplemental Instructions:

1. Minor changes in the work shall be carried out in accordance with supplemental instructions issued in accordance with the Contract Documents without change in Contract Sum/ Contract Price or Contract Time.

2. The Architect will issue, sign, and date Supplemental Instructions.

3. The Contractor will sign and date Supplemental Instructions to indicate acceptance of minor changes consistent with the Contract Documents and return signed copy to Architect.

1.13 CORRELATION WITH CONTRACTOR'S SUBMITTALS

A. Periodically revise Schedule of Values and Request for Payment forms to record each change as a separate item of Work and to record the adjusted contract amounts.

B. Periodically revise the Construction Schedule to reflect each change in Contract Time.

C. Revise sub-schedules to show changes for other items of work affected by the changes.

D. Upon completion of work under a Change Order, enter pertinent changes in Record Documents.

1.14 FORMS

A. Submit Proposal Request typed on AIA Document G709. A Copy of this form may be obtained from the local American Institute of Architects, Chapter Office

B. Submit Change Orders typed on the Change Order Form included in this Project Manual. Form is included in General Conditions and at the end of this Section.

C. Submit Potential Change Order on the Potential Change Order Form included in this Project Manual. Form is included in General Conditions and at the end of this Section

D. Submit Supplemental Instructions typed on the form included in this Project Manual on 01 30 50-24, Requests For Information (RFI's).

E. Immediate Change Directive Form is included in the Supplementary General Conditions.

PART 2 – PRODUCTS - (Not Applicable)

PART 3 – EXECUTION - (Not Applicable)

END OF SECTION

This page intentionally left blank.

SECTION 012669 - CONSTRUCTION CHANGE DOCUMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Construction Change Documents.

B. Related Requirements:

1. Section 012600 "Contract Modification Procedures" administrative and procedural requirements for handling and processing Contract modifications.

1.03 DEFINITIONS

A. Approved Construction Documents: The Structural, Access, or Fire and Life Safety related portions of the plans, specifications, addenda, deferred approvals, revisions, and construction change documents duly approved by DSA.

B. Change: Revisions, deletions, additions, and substitutions to Approved Construction Documents.

C. Change Order: A document defining construction changes that result in changes to the Contract.

D. Clarification: A statement from the Architect or Engineer in general responsible charge of the project that clarifies (but does not change) the requirements of the Approved Construction Documents.

E. Contract: A written agreement for construction, alteration, repair or other construction activities associated with facilities regulated by DSA.

F. Construction Change: Changes to the Approved Construction Documents after a contract for the Work has been awarded.

G. Construction Change Document (CCD): The documentation of Construction Changes.

H. Design Professional in General Responsible Charge: The Architect or Engineer in general responsible charge of the project as listed on Line 23 of form DSA 1, "Application for Approval of Plans and Specifications."

I. Drawing: An illustration on paper or electronic medium.

J. Field Change Document (FCD): A document defining Construction Changes but, unlike Change Orders, does not require approval of the school board nor an accounting of construction cost changes.

K. Interpretation: A statement from the Architect or Engineer in general responsible charge of the project that interprets (but does not change) the requirements of the Approved Construction Documents.

L. Responsible Design Professional: The Architect or Engineer in general responsible charge of the project, as listed on Line 23 of form DSA 1, or Architects or Engineers with delegated responsibility for portions of the project as listed on Line 24a-24d or 25 of form DSA 1.

1.04 CONSTRUCTION CHANGE DOCUMENTS

A. Construction Changes: Changes of the approved plans or specifications after a contract for the work has been let shall be made by means of Construction Change Documents. Construction Change Documents for changes to the structural, accessibility, or fire-life safety portions of the project shall be submitted to and approved by DSA prior to commencement of the work shown thereon. Construction Change Documents shall refer to the portions of the approved plans and specifications being changed, clearly describe the work to be accomplished, and, where necessary, shall be accompanied by supplementary drawings, technical data, and calculations. Construction Change Documents shall be numbered sequentially for easy reference. All Construction Change Documents shall be stamped and signed by the Architect or Engineer in general responsible charge, or by the Architect or Registered Engineer delegated responsibility for the portion of the work of construction affected by the change per CAC Section 4-338(c).

1. If required by DSA, all other Construction Change Documents shall be submitted to the DSA for concurrence that they do not contain changes to the structural, accessibility, and/or fire-life safety portions of the Project.

B. Interpretation of Regulations A-6 (IR A-6) provides clarification of specific Code requirements relating to construction changes that must be submitted to the Division of the State Architect (DSA) and defines the construction change document process.

C. Submittal Requirements for Construction Changes:

1. After a contract for the work has been let, changes to the Approved Construction Documents shall be made by means of a Construction Change Document (CCD).
2. It is the responsibility of the design professional in general responsible charge to determine if changes affect the Structural, Access, or Fire and Life Safety portions of the project. (See "Duties Of Design Professional in General Responsible Charge" paragraph below about the statement on the verified report.)
3. The design professional in general responsible charge shall prepare the Construction Change Document (CCD) and is responsible for code and process compliance.
4. The following define requirements for submittal of a Construction Change Document (CCD) to DSA.

a. Changes to or affecting the Structural, Access, or Fire and Life Safety Portions of the project:

1) These changes shall be classified as Construction Change Documents Category A.
2) A Construction Change Document Category A is required to be submitted to and approved by DSA prior to commencement of the affected work.
3) A Construction Change Document Category A must be submitted to DSA using form DSA 140, "Application for Approval of Construction Change Document - CCD Category A/B" available on the DSA forms page. Submittal process requirements are defined in "Submittal Process" paragraph below and must be followed.

b. Changes not affecting the Structural Safety, Access Compliance, or Fire and Life Safety Portions of the Project:

1) These changes shall be classified as Construction Change Documents Category B.
2) Construction Change Documents Category B are not required to be submitted to DSA unless specifically required, in writing, by DSA. However, a design professional, at their discretion, may choose to submit a Construction Change Document Category B.
3) If DSA requires any Construction Change Documents Category B to be submitted, then they shall be submitted to DSA, similar to Construction Change Documents Category A, using form DSA 140 "Application for Approval of Construction Change Document - CCD Category A/B" available on the DSA forms page.
4) If DSA requires a Construction Change Document Category B to be submitted, then DSA will review for concurrence that it does not contain changes to or affect the Structural, Access, or Fire and Life Safety portions of the project. If necessary, and at its sole discretion, DSA will re-assign the Construction Change Document to Category A.
5) If DSA concurs the document is a Category B document, an approval stamp will be applied to the document.

c. Change Orders: Change Orders are not required to be submitted to DSA. The Construction Change Document process replaces the need to submit Change Orders unless otherwise indicated.

1) Changes to the construction cost are reported to DSA using form DSA 168, "Statement of Final Actual Project Cost" at the conclusion of the project.

D. Submittal Process:

1. Submittal of Construction Change Documents (CCDs) must conform to the following requirements:

a. Must be submitted by the design professional in general responsible charge.
b. Must be submitted to DSA using form DSA 140 "Application for Approval of Construction Change Document - CCD Category A/B" available on the DSA forms page.
c. Each Construction Change Document submittal must use a separate DSA Construction Change Document form.
d. The DSA Construction Change Document form must be filled out completely, including identification of the Construction Change Document Category A or B, leaving no fields blank. For Category B Construction Change Documents, indicate whether the submission is voluntary or DSA required. When DSA provides written direction compelling submission of a CCD Category B, attach a copy of the DSA written notification compelling submission.
e. Each Construction Change Document must be uniquely numbered. The numbering may be numeric or alpha-numeric.

1) If the submitted Construction Change Document is returned by DSA not approved, the Construction Change Document number used in the original submittal must remain the same for any subsequent re-submittals.
2) If a submitted Construction Change Document Category B is returned by DSA not approved, the Construction Change Document number used in the original submittal must remain the same when re-submitting as a Construction Change Document Category A.

f. Proposed changes must be described clearly and completely.
g. All drawings, and, when applicable, the first page or index of specifications and calculations associated with the proposed change must be stamped, signed, and indicate date of signing by the responsible design professional as an attachment to form DSA 140.

h. Reference to the specific portions of the drawings or specifications that are being changed must be included.

i. Changes to any testing or inspection requirements associated with the proposed change must be clearly described with a revised form DSA 103, "List of Required Structural Tests and Special Inspections - 2016 CBC."

j. Each page in the Construction Change Document, including the pages in each attachment, shall be clearly and uniquely numbered. All drawings attached to describe the changes shall be clearly numbered, labeled, and referenced.

k. When drawings containing DSA approval stamps are revised and reissued as part of the Construction Change Document, all of the following requirements must be met:

1) Images of all DSA approval stamps must be removed from the drawing (or crossed out) prior to making any changes to the drawings.
2) Each change shall be clouded and identified on the drawing.
3) All drawings must be re-stamped and re-signed by the responsible design professional. The date of signing shall be provided.

l. Construction Change Document Submittal to DSA: DSAbox is utilized for Construction Change Document submittals. Each Construction Change Document shall be submitted as a single document and include form DSA 140 as the first page. In some cases, large size drawings associated with Construction Change Documents may need to be submitted as a hard copy to the appropriate DSA regional office. The design professional should contact the DSA regional office to determine file size limitations and submittal guidelines, and review DSAbox instructions in the DSAbox External Library, Module 2.13.

E. Review and Approval/Concurrence by DSA:

1. DSA will charge fees in accordance with IR A-30 "DSA Hourly Fee Services" for all Category A Construction Change Documents submitted to DSA for approval. Category B Construction Change Documents voluntarily submitted by the design professional to DSA will be charged fees for review and concurrence. Category B Construction Change Documents required by a DSA representative to be submitted will not cause charged fees if DSA concurs the Construction Change Document is Category B.

a. Construction Change Documents Category A:

1) DSA reviews Construction Change Documents Category A for minimum compliance with the codes regulating the Structural, Access, and Fire and Life Safety portions of the project.
2) If not approved by DSA, then the Construction Change Document is returned to the design professional in general responsible charge for correction in DSAbox as described in DSAbox External Library, Module 2.13. DSA will return the document for correction with a form DSA 140 attached indicating the status of the review and update eTracker accordingly. After corrections are made then the Construction Change Document is re-submitted (must include the DSA comments and a copy of the form DSA 140 from the previous unapproved submittal) following the submittal process outlined in "Submittal Process" paragraph. Refer to "Construction Change Document Submittal to DSA" subparagraph for information regarding electronic submittals to DSAbox.
3) If approved by DSA, then DSA places the approved Construction Change Document in DSAbox as described in DSAbox External Library, Module 2.13 (see "Duties of Design Professional in General Responsible Charge" paragraph for requirements for distribution by the design professional in general responsible charge). Refer to "Construction Change

Document Submittal to DSA" subparagraph for information regarding electronic submittals to DSAbox.

b. Construction Change Documents Category B:

1) DSA reviews Construction Change Documents Category B to provide concurrence that the changes do not affect the Structural, Access, or Fire and Life Safety portions of the project.
2) DSA approval of Construction Change Documents Category B is not approval for code compliance, but is concurrence that the documents do not change the Structural, Access, and/or Fire and Life Safety portions of the project.
3) If not approved by DSA, then the Construction Change Document is returned to the design professional in general responsible charge for correction in DSAbox as described in DSAbox External Library, Module 2.13. After corrections are made, then the Construction Change Document is re-submitted using Construction Change Document Category A form DSA 140 (must include the DSA comments and a copy of the form DSA 140 from the previous unapproved submittal) following the submittal process outlined in "Submittal Process" paragraph. Refer to "Construction Change Document Submittal to DSA" subparagraph for information regarding electronic submittals to DSAbox. The remaining review process will follow that for Construction Change Document Category A described in "Construction Change Documents Category A" subparagraph.
4) If approved by DSA, then DSA places the approved Construction Change Document in DSAbox as described in DSAbox External Library, Module 2.13. Refer to "Construction Change Document Submittal to DSA" subparagraph for information regarding electronic submittals to DSAbox.

F. Duties of Design Professional in General Responsible Charge:

1. Distribution of Construction Change Document Category A Documents: The design professional in general responsible charge shall provide the contractor and project inspector with DSA approved Construction Change Document Category A prior to commencement of work shown thereon.
2. Construction Change Document Category A Statement in Final Verified Report. The final verified report (form DSA 6-A/E "Architect/Engineer Verified Report") from the design professional in general responsible charge must include a statement that all changes to or affecting the Structural Safety, Access Compliance, or Fire and Life Safety portions of the project have been approved by DSA. The intent for all projects is that this final verified report be dated after the approval of those Construction Change Documents.

G. Duties of the Project Inspector with Respect to Construction Change Documents:

1. The project inspector shall follow the Construction Change Document Category A record-keeping and monitoring requirements, issuing deviation notices when appropriate, as specified in IR A-8 "Project Inspector and Assistant Inspector Duties and Performance: 2016, 2013, 2010, and 2007 CAC."

H. Monitoring of Changes by the DSA:

1. If the DSA determines that changes to the plans or specifications appear to require DSA approval (changes affecting the Structural Safety, Access Compliance, or Fire and Life Safety portions of the project), DSA shall notify the design professional in responsible charge and require the changes to be submitted for review and approval by DSA or require evidence the changes are Construction Change Document Category B.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 ATTACHMENTS

A. Appendix A - Sample form DSA 140 "Application for Approval of Construction Change Document - CCD Category A/B."

END OF SECTION 012669

DSA **140**

APPLICATION FOR APPROVAL OF CONSTRUCTION CHANGE DOCUMENT – CCD CATEGORY A/B

This application is for construction changes, as defined in IR A-6, to approved contract documents. This form shall be completed by the Design Professional in General Responsible Charge of the project, in accordance with California Code of Regulations, Title 24, Part 1, Section 4-338 (c) and in compliance with DSA IR A-6.

School District/Owner:	DSA File #: -
Project Name/School:	DSA App. #: -

APPLICANT

CCD Cat. ☐ A / ☐ B, #:	Date Submitted:	Attached Pages?: ☐ No ☐ Yes (_____ pages)
For CCD Cat. B, this is a ☐ voluntary submittal, ☐ DSA required submittal (attach DSA notification requiring submission).		
Firm Name:	Contact Name:	
Email:	Phone Number:	
Address:		
City:	State:	Zip:
☐ A DSA 301-N, DSA 301-P, or 90-Day Letter has been issued for this project.		
☐ For project currently under construction.		
☐ To obtain DSA approval of existing uncertified building(s).		

DESIGN PROFESSIONAL IN GENERAL RESPONSIBLE CHARGE

Name of Design Professional in General Responsible Charge:	
Professional License #:	Discipline:

Design Professional in General Responsible Charge Statement: The attached Construction Change Documents have been examined by me for design intent and appear to meet the appropriate requirements of Title 24, California Code of Regulations and the project specifications. They are acceptable for incorporation into the construction of the project.

Signature: _____

DESIGN PROFESSIONAL IN GENERAL RESPONSIBLE CHARGE

CHECK THIS BOX: ☐ To confirm that **all** CCD drawings and, when applicable, first sheet or index of calculations and specifications have been stamped and signed by the Responsible Design Professional listed on DSA 1 for this this project.

Brief description of construction change (attach additional sheets if needed):

List of DSA approved drawings affected by this CCD:

DSA USE ONLY

SSS_____Date_____ Approved / Disapproved / Not Req'd

FLS_____Date_____ Approved / Disapproved / Not Req'd

ACS_____Date_____ Approved / Disapproved / Not Req'd

Remarks_____

For business office use only

Date Sent_____

Return By_____

Delivery Method_____

DSA Stamp

This page intentionally left blank.

COMPTON COMMUNITY COLLEGE DISTRICT

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.

B. Submit applications for payment to Construction Manager in accordance with the schedule established by the conditions of the Contract and Agreement between Owner and Contractor.

C. The Contractor's Construction Schedule and Submittal Schedule are included in Section "Submittals".

D. The Contractor agrees to provide an updated certified “As-Built” with every pay application both “Hard Copy” and electronic copy that is approved by the Architect/ Engineer, Inspector of Record, and the Construction Manager.

1.2 SCHEDULE OF VALUES

A. Coordinate preparation of the Schedule of Values with preparation of the Contractor's Construction Schedule.

1. Submit the Schedule of Values to the Construction Manager at the earliest feasible date, but in no case later than 10 days before the date scheduled for submittal of the initial Application for Payment.

B. Format and Content: Use the Project Manual Table of Contents as a guide to establish the format for the Schedule of Values.

1. Identification: Include the following Project identification on the Schedule of Values:

a. Project name and location.

b. Name of the Architect/ Engineer.

c. Project number.

d. Contractor's name and address.

e. Date of submittal.

2. Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed:

a. Generic name.

b. Related Specification Section.

c. Name of subcontractor.

d. Dollar value.

e. Percentage of Contract Sum/ Contract Price to the nearest one-hundredth percent, adjusted to total 100 percent.

3. Provide a breakdown of the Contract Sum/ Contract Price in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into specific line items.

4. Round amounts off to the nearest whole dollar; the total shall equal the Contract Sum/ Contract Price.

5. For each part of the Work where an Application for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed, provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

6. Schedule Updating: Update and resubmit the Schedule of Values when Change Orders or Construction Change Directives result in a change in the Contract Sum/ Contract Price.

1.3 APPLICATIONS FOR PAYMENT:

A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Architect/ Engineer and paid for by the School District.

B. Payment Application Times: Each progress payment date is as indicated in the Agreement. The period of construction Work

covered by each Application or Payment is the period indicated in the Agreement.

C. Payment Application Forms: Use AIA Document G702 and Continuation Sheets G 703 as the form for Application for Payment.

D. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the School District. Incomplete applications will be returned without action.

1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.

2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.

3. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the Engineer and Construction Manager.

4. When the Architect/ Engineer finds the application completed and correct will transmit a certificate for payment to Owner with a copy to the Contractor.

E. Lien Releases: With each Application for Payment submit Lien Releases from subcontractors or sub- subcontractors and suppliers for the construction period covered by the previous application.

1. Submit partial Lien Releases on each item for the amount requested, prior to deduction for retainage, on each item.

2. When an application shows completion of an item, submit final or full Lien Releases.

a. Submit final Application for Payment with or preceded by final Releases from every entity involved with performance of Work covered by the application that could lawfully be entitled to a lien.

3. Waiver Forms: Submit waivers of lien on forms, and executed in a manner, acceptable to the School District.

F. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include, without limitation, the following (see also General Conditions):

1. List of subcontractors.

2. Schedule of Values.

3. Contractor's Construction Schedule (preliminary if not final).

4. Copies of authorizations and licenses from governing authorities for performance of the Work.

5. Certificates of insurance and insurance policies.

6. Performance and payment bonds (if required).

G. Application for Payment at Substantial Completion: Upon Substantial Completion, submit an Application for Payment.

1. Administrative actions and submittals that shall proceed or coincide with this application include, without limitation, the following (see also General Conditions):

a. Project inspector's status of completion report.

b. Warranties (guarantees) and maintenance agreements.

c. Test/adjust/balance records.

d. Maintenance instructions.

e. Meter readings.

f. Start-up performance reports.

g. Change-over information related to Owner's occupancy, use, operation and maintenance.

h. Final cleaning.

i. List of incomplete Work, recognized as exceptions to the Certificate of Substantial Completion.

H. Final Payment Application: Administrative actions and submittals that must precede or coincide with submittal of the final payment Application for Payment include, without limitation, the following (see also General Conditions):

1. Completion of Project closeout requirements.

2. Completion of items specified for completion after Substantial Completion.

3. Assurance that unsettled claims will be settled.

4. Assurance that Work not complete and accepted will be completed without undue delay.

5. Transmittal of required Project construction records to Owner.

6. Removal of temporary facilities and services.

7. Removal of surplus materials, rubbish and similar elements.

8. Submit the final complete “As-builts” both hard copy and electronic copies with proper electronic titles for each page.

PART 2 – PRODUCTS - (Not Applicable)

PART 3 – EXECUTION - (Not Applicable)

END OF SECTION

This page intentionally left blank.

COMPTON COMMUNITY COLLEGE DISTRICT

COMPTON COMMUNITY COLLEGE DISTRICT
1111 E. Artesia Blvd
Compton, California 92553
(310) 900-1600

RFQ CCC-055 Instructional Building 2

POST BID INTERVIEW

1.1 SUMMARY

This Section requires each apparent low bidder to attend and participate in a POST BID INTERVIEW with the CONSTRUCTION MANAGER, prior to award of any contract by the DISTRICT. The POST BID INTERVIEW will be scheduled by the CONSTRUCTION MANAGER within three (3) calendar days after the date of bid. The Conditions of the Contract and all other Sections of the Contract apply to this Section as fully as if repeated herein.

1.2 REQUIRED ATTENDANCE

A. A duly authorized representative of the apparent low bidder is required to attend the POST BID INTERVIEW, in person.

B. The apparent low bidder's authorized representative must have signatory authority on behalf of the apparent low bidder.

C. Failure to attend the POST BID INTERVIEW will be considered just cause for the District to reject the Bid.

Initials: _____ _____
Contractor Construction Manager

1.3 POST BID INTERVIEW PROCEDURE

A. The CONSTRUCTION MANAGER will review the Bidder's Proposal with the attendees.

B. The CONSTRUCTION MANAGER will review the Contract Documents with the attendees, including but not limited to:

1. Insurance
2. Bonding
3. Addenda
4. Pre-Bid Clarifications
5. Scope of Work (Section 01 01 00)
6. Bid Alternates and Voluntary Alternates
7. Value Engineering
8. The Contract Plans
9. The Contract Specifications
10. The Master Schedule
11. Critical Materials
12. General Contract Schedule Requirements
13. Prevailing Wage Requirements
14. Critical Dates Requirement for Other Bid Packages
15. Liquidated Damages
16. Required Documentation for Contract Administration
17. Contract Coordination Requirements

1.4 POST BID INTERVIEW DOCUMENTATION

The CONSTRUCTION MANAGER will document the POST BID INTERVIEW on the form attached to this Section. Both the Apparent Low Bidder and the CONSTRUCTION MANAGER are required to sign the POST BID INTERVIEW Documentation. Signatures will be witnessed at the time of signing. POST BID INTERVIEWS will be conducted at the CONSTRUCTION MANAGER jobsite trailer.

Initials: _____ _____
Contractor Construction Manager

COMPTON COMMUNITY COLLEGE DISTRICT

POST BID INTERVIEW FORM

CONSTRUCTION MANAGER FIRM
PCM3, Inc.
1111 E. Artesia Blvd.
Compton, CA 90221

BIDDER: _____

DATE: _____ TIME: _____ PHONE # _____

I. INTRODUCTIONS: (SIGN IN BELOW)

A. Present

_____ CONTRACTOR	_____ CONTRACTOR
_____	_____
_____	_____
_____ CONSTRUCTION MANAGER	_____ CONSTRUCTION MANAGER

II. PROPOSED CONTRACT: _____

III. PURPOSE OF INTERVIEW IS TO ASSURE:

A.	Contractor acknowledgment of a complete and accurate bid.	Yes	No
B.	Contractor submission of a fair and equitable bid.	Yes	No
C.	Fair comparisons of bid.	Yes	No

Initials: _____ Contractor _____ Construction Manager

IV. CONTRACTUAL REQUIREMENTS:

A.	Do you understand you are a prime contractor?	Yes	No
B.	Can you meet all specified insurance requirements?	Yes	No
C.	You are required to obtain a Performance, and a Labor and Material Bond for 100% of the Contract price	Yes	No
1.	Is this acceptable?	Yes	No
2.	Will you provide bonds as stipulated?	Yes	No
3.	Cost for bond: _____%	Yes	No
4.	Is the cost of the bond in your base bid?	Yes	No
5.	Is your insurance company California licensed?	Yes	No
D.	Acknowledged Receipt of Addenda _____1 _____2 _____3 _____4 _____5		
E.	Acknowledged Receipt of Pre-Bid Clarification Questions	Yes	No
F.	Are any costs for addenda items included in your proposal (if applicable)?	Yes	No

V. SCOPE OF WORK:

A.	You have a complete understanding of your Scope of Work under the proposed Agreement	Yes	No
B.	You have re-reviewed the documents and understand the Scope of the Work. Are there any items that need to be identified or require clarification?	Yes	No

If yes, please identify item.

1. _____
2. _____
3. _____
4. _____
5. _____

	Is (are) the cost(s), as applicable, included in your proposal items?		Yes	No
C.	Review bid alternates (if applicable)	NONE	Yes	No
D.	Are you offering any unsolicited alternates?	NONE	Yes	No

Initials: _____ _____
Contractor Construction Manager

1. _____
2. _____
3. _____

E. Are the plans and specifications clear and understandable to your satisfaction? Yes No

VI. VALUE ENGINEERING: (describe for District Consideration)

1. _____
   _____ Add / Deduct _____
2. _____
   _____ Add / Deduct _____
3. _____
   _____ Add / Deduct _____
4. _____
   _____ Add / Deduct _____

AFFECTED TOTAL $_____

VII. SCHEDULE:

A. Do you acknowledge and agree to the stipulated completion dates and milestones in the Contract? Yes No

1. Will you provide a detailed construction schedule to CONSTRUCTION MANAGER within the required three (3) days, per the Contract? (Section 00700) Yes No
2. Can you expedite the schedule without impact to others? Yes No
3. It is understood the Project schedule is critical. Can you accelerate any and all schedule activities if the requirement occurs? Yes No
   If not, what must change and why? _____
   _____
   _____

Initials: _____ _____
Contractor Construction Manager

B. Identify critical materials, deliveries and dependencies, including Owner Furnished items that could affect the completion of your work. Yes No

1. _____

2. _____

3. _____

C. You have reviewed Section 01 43 80, CONSTRUCTION SCHEDULE and you understand your work must be completed in accordance with the **Master Schedule**. You further understand the District **MAY** assess liquidated damages if you fail to meet the Master Schedule requirements. You further understand delays by you may cause other contractors to be delayed, and that you **WILL** accelerate your work upon written direction by the CONSTRUCTION MANAGER.

CRITICAL DATES

PROJECT COMPLETION

Milestone Dates

Notice of Award and State Chancellor Office Approval	TBD
All Submittals received by Construction Manager	25 Days After Notice of Award
All Shop Drawings received by Construction Manager	45 Days After Notice of Award
Provide Detailed Construction Schedule	15 Days After Notice of Award
Mobilize	TBD
Construction Completed by	TBD
Final Cleanup, Punchlist, and Closeout	TBD

You agree that failure to meet the date is just cause for the DISTRICT to assess and retain Liquidated Damages in accordance with the Contract Documents.

VIII. CONTRACTOR COMMENTS / SUGGESTIONS:

1. _____

2. _____

3. _____

4. _____

5. _____

Initials: _____ _____
Contractor Construction Manager

IX. CONTRACTOR

The foregoing information is true and accurate, and I am authorized to sign as an office of the company I am representing.

Company Name _____

Signature: _____ Title: _____

Date: _____

X. CONSTRUCTION MANAGER

Signature: _____ Title: _____

Date: _____

XI. Witness:

Signature: _____

Date: _____

END OF SECTION

Initials: _____ _____
Contractor Construction Manager

This page intentionally left blank.

CONSTRUCTION PROCEDURE MANUAL

COMPTON COMMUNITY COLLEGE DISTRICT

COMPTON COMMUNITY COLLEGE DISTRICT
Construction Procedures Manual

TABLE OF CONTENTS

COMPTON COMMUNITY COLLEGE DISTRICT
Construction Procedures Manual

I. INTRODUCTION

This Construction Procedures Manual has been developed for the Compton Community College District.

The purpose of this Manual is to provide the Owner, the Architect, Engineer, Inspector and Contractors detailed information concerning the specific project requirements and procedures.

This manual delineates lines of authority and responsibility of the team members associated with this Project.

Questions or suggested changes to this manual may be addressed to the Construction Manager, at 1111 E. Artesia Blvd., Compton, CA 90221

SHOULD INCONSISTENCIES OR DISCREPANCIES EXIST BETWEEN THIS MANUAL AND THE CONTRACT DOCUMENTS (INCLUDING THE GENERAL CONDITIONS); THE CONTRACT DOCUMENTS (INCLUDING THE GENERAL CONDITIONS) WILL TAKE PRECEDENCE.

II. PROJECT PROCEDURES

A. COMMUNICATIONS

1. In carrying out the terms of the Contract, the Owner and the Architects/Engineer will interact with the Contractors through the Construction Manager.

2. All correspondence, shop drawings, submittals, RFIs etc. are to be processed and submitted through the Construction Manager.

3. All correspondence, shop drawings, submittals, RFIs etc. shall reference the Project by name and Contract number.

4. The Construction Manager is the point of contact for all Project communications.

B. MEETINGS

1. Pre-Construction Meeting - (Section 01 31 00)*

After award of the Contract, the Construction Manager will schedule a "Pre-Construction Meeting" to be held at a time and location designated by the Construction Manager. **An authorized representative of Contractor MUST attend the "Pre-Construction" meeting**. Minutes of the meeting will be prepared and distributed by the Construction Manager

2. Weekly Project Meeting - (Section 01 31 00)*

a. The Construction Manager will conduct a weekly Project meeting in the on site office.

b. Contractor with crews on site and upcoming work must attend weekly meetings.

c. Persons required to attend the weekly Project meetings include Contractor's supervisory personnel, subcontractor personnel, (as appropriate), the Construction Manager, A/E, and others as requested by the Construction Manager. The Owner or User personnel may attend at any time.

d. The Contractor(s) shall bring any documentation as may be required in order to accomplish a joint review and status of the Project activities.

e. Contractor(s) shall prepare a two week "look ahead" schedule for review at each meeting. The schedule shall be prepared in accordance with the scheduling section of this manual and will be reviewed with the contract schedule at each weekly meeting.

3. Special Project Meetings

The Construction Manager may call a Special Project Meeting at any time during the course of the Project. Special Project Meetings, if deemed necessary, shall include representatives of the Contractor(s) and subcontractors as requested in order to provide an adequate line of communication to discuss problems and/or solutions that are common to the Project.

C. SITE RULES

1. The Compton Community College District Campus is Non-Smoking and Drug Free.

2. The Compton Community College District Campus is alcohol free.

3. All personnel are required to wear appropriate protective clothing, work shoes, and safety equipment at all times.

4. All personnel shall restrict their behavior, their language and their demeanor so as to avoid harassment to students and faculty.

5. Violations of Site Rules may result in permanent banning from the Project.

D. PROJECT DOCUMENTS All Construction Manager Document Control will be administered utilizing Prolog 9.5 (or later) software.

1. SUBMITTALS - (Specification Section 01 33 00) *

a. Contractor shall submit all shop drawings, samples and product data through the Construction Manager within the time requirements set forth in the General Conditions.

* References are to Specification Sections; refer to section for more detailed requirements.

b. Every Submittal shall be made to the Construction Manager at the Project site, using the enclosed submittal form. A separate form must be filled out for each submittal. At a minimum, every submittal shall contain the following information and any other information required by the General Conditions:

1. Project Name
2. Contractors Name & Address
3. DSA Application Number _____ and File Number _____ for each school.
4. Submittal Number according to the Submittal Registry.
5. Submittal Date
6. Specification and/or Drawing Reference.
7. Contractor Name and Address
8. Index of Items Submitted
9. Number of Copies.

Each submittal must be complete in all forms to allow review without further contact with the Contractor.

c. **CONTRACTOR WILL STAMP AND SIGN SUBMITTALS, SHOP DRAWINGS, ETC. THAT HE HAS REVIEWED THE ITEMS SUBMITTED, AND CERTIFIES THE ITEMS ARE IN ACCORDANCE WITH THE CONTRACT DOCUMENTS, AND THAT EACH HAS BEEN CHECKED FOR DIMENSIONS AND RELATIONSHIPS WITH WORK OF ALL OTHER CONTRACTORS AND TRADES INVOLVED.**

d. Upon receipt, the Construction Manager will log each submittal. The Construction Manager may reject any submittal if it is, in his or her judgment, incomplete or inadequate. In such case, one copy of the rejected submittal will be retained by the Construction Manager with remaining copies returned to the Contractor with the reason for rejection cited.

e. All Submittals shall be numbered by the Contractor as follows:

Start with the Submittal number, followed by the complete specification section number of the item submitted. For example, assuming Reinforcing Steel is required by Specification Section 00 33 00.3.2 and it is the first submittal, the Submittal number for this example is: 0001-003300.2.3. In the event there is a revision required to a submittal, the re-submittal uses the same number as the original, appended with "Rev. 1". The Submittal example then would read: 0001-003300.2.3 - Rev. 1.

f. Upon completion of the preliminary review, the Construction Manager will transmit acceptable submittals to the A/E for review and comment.

E. A/E REVIEW COMMENTS

1. The A/E will review all submittals and, where appropriate, make written commentary. The A/E's comments will be similar to the following:

a. "NO EXCEPTIONS TAKEN" - the Contractor may proceed with work covered by the submittal.

b. "MAKE CORRECTIONS NOTED" - The Contractor may proceed with the work, provided the Contractor proceeds in accordance with the notes and comments on the submittal.

c. "REVISE and RESUBMIT" - the Contractor shall NOT begin any work covered by the submittal until a revision or correction to the submittal has been re-submitted, reviewed and returned to the Contractor.

d. "REJECTED" - the Contractor shall not begin any work covered by the submittal until a new submittal has been prepared, submitted and reviewed.

F. SUBMITTAL & SHOP DRAWING QUANTITIES

1. Submittals, Shop Drawings and Product Data shall be submitted in the following minimum quantities:

a. SAMPLES: Three or more samples.

b. SHOP DRAWINGS: One (1) reproducible and seven (7) copies.

c. PRODUCT DATA: Seven (7) copies.

G. DISTRIBUTION OF REVIEWED SUBMITTALS

1. SHOP DRAWINGS - Seven Sets
   One (1) reproducible and One (1) copy to Contractor
   One (1) copy retained by Architect
   One (1) copy retained by the Consultant/Engineer
   One (1) copy retained by the DSA Inspector
   Two (2) copies to the Construction Manager
   One (1) copy to the District

2. PRODUCT DATA - Seven Sets
   Three (3) sets to Contractor
   One (1) copy retained by Architect
   One (1) copy retained by the Consultant/Engineer
   One (1) copy retained by the DSA Inspector
   One (1) copy to the Construction Manager

If Contractor requires additional reviewed copies of shop drawings or product data, he shall print copies from the reproducible at Contractor's expense.

Fabrication or other work performed in advance of receipt of reviewed drawings, samples or test certifications will be entirely at the Contractor's risk.

H. REQUEST FOR INFORMATION (RFI)

Should the Contractor(s) require clarification or additional information of the plans or specifications, he will direct the request to the Construction Manager on the RFI form as provided by the Construction Manager. Sample forms are in the appendix.

Each RFI will be numbered sequentially. Contractor shall be responsible for maintaining his own "log". The Construction Manager will maintain the Construction Manager's RFI log, and each week, the Construction Manager RFI Log will be distributed & discussed at the weekly meeting.

The RFI shall describe thoroughly, the problem or clarification being requested and a suggested solution. The description provided should be adequate and complete to permit a written response without additional communication with the Contractor. The Contractor shall attach related sketches, information or correspondence which may have been received from subcontractors or vendors on the subject. Each attachment to the RFI shall have the RFI # marked plainly on the attachment pages are to be numbered "Page __of __." In instances where the Contractor believes there may be a conflict between elements of the plans and specifications, he should identify the conflict and indicate the manner in which he interpreted the sections in preparing his bid.

No RFI will be accepted without proper reference to Plan Drawings, Shop Drawings and / or Specification Sections, and all areas completely filled out.

The contractor shall list potential solutions to expedite resolution by the Architect and Owner and the contractor shall insure that all line items in the RFI Form are completely filled out before submitting to the Construction Manager.

The Construction Manager will review the RFI and will either:

1. Return the RFI to the Contractor for additional information or response.

2. Forward the RFI to the Architect of Record for response, copying the Project Inspector in accordance with the below timelines.

3. Provide the response within twenty-four (24) hours and return to the Contractor, with copies to the Architect of Record and Project Inspector. RFI's answered by the CM are logged as official RFI's and subject to all of the below conditions.

The timeline scenario for a routine RFI shall be as follows:

1. CM will verify all RFI's for format and content prior to any disposition and may return to sender for edit, clarification and completeness.

2. When a Contractor submits an RFI to the CM it must be reviewed within twenty-four (24) hours. If the RFI is deemed legitimate by the CM and In the event that the CM is not able to adequately answer the RFI in the twenty-four (24) hour period it must be immediately transmitted to the Architect of Record.

3. Once the Architect receives the RFI from the CM, he must respond or pass the RFI on to the proper consultant within three (3) days. (In a Modernization project, the Architect must answer or pass the RFI on to a Consultant with in twenty-four (24) hours.)

4. Consultants are given a maximum of seven (7) days to respond or show cause for delay. (For a Modernization Project this period is shortened to three (3) days.)

5. The appropriate recipient of the RFI will endeavor to provide the response as soon as possible within the above time constraints.

6. When the Construction Manager receives a response back from the Architect, the answer should be reviewed and transmitted to the Contractor as soon as possible and within twenty-four (24) hours. A sixty (60) minute turnaround is preferred.

7. All RFI's properly executed, answered and reviewed must be posted on plans within twenty-four (24) hours of receipt by the CM.

8. In the event an RFI goes unanswered for a period of thirty (30) days or longer it shall be subject to weekly habeas corpus hearings, in which the CM, Architect, Project Inspector, and appropriate Consultant shall attend.

RFI's requiring critical response timing shall be duly annotated as to the urgency of the response date.

If the RFI review indicates a change or revision is necessary to the Contract Documents, the A/E will prepare appropriate drawings and/or specifications required to define the change or revision.

If the Contractor believes the clarification or direction provided by the response to the RFI will impact the cost or schedule of the Project, he shall provide prompt notification thereof to the Construction Manager in accordance with the General Conditions. Upon notification thereof to the Construction Manager, the Contractor shall prepare an Allowance Usage Request or Proposed Change Order, if approved by the District thru the Construction Manager, which shall be processed as outlined in the Change Order Procedure of this manual. In the event the Contractor fails to notify the Construction Manager, no consideration will be given to the Contractor for additional costs as outlined in the Change Order Procedure.

See also Project Coordination Section (01 31 00, 1.06 Requests for Information) regarding frivolous Requests for Information.

I. SCHEDULES

The Contractor shall furnish to the Construction Manager any required schedules that addresses the work in his Contract(s) in accordance with the General Conditions. The schedules shall be in a format as approved by the Construction Manager, and as a minimum, shall include, without limitation, the following (see also General Conditions):

1. Detail of activities required for their mobilization and start of construction.

2. Activities of other Contractors which must be completed prior to starting various components of other work.

3. A plan for completion of work in sufficient detail to allow observation and monitoring by the Construction Manager. Any activity longer than five (5) working days shall be broken down into phases of five (5) working days or less in length.

4. List activities which must be complete for succeeding contractors to start their work.

5. Show submittals and shop drawing preparation and review time.

6. Long lead procurement requirements.

7. Include all necessary and required DSA Inspections in Schedule.

The Contractor shall prepare schedules in a Critical Path Method (CPM) format as required by the General Conditions. Contractor will review the logic and duration of activities affecting his work. The Construction Manager will conduct a meeting with Contractor(s) to incorporate revisions and issue the approved construction schedule.

The schedule will become the basis for determining completion of the Project and will be reviewed at each weekly meeting.

Contractor will prepare and submit at each weekly meeting a Short Interval Schedule (SIS). The SIS shall be a two (2) week Projection of activities currently in progress or to be started within the following two (2) week period (use form within this manual).

The SIS will be reviewed against the base Contract Schedule each week to evaluate the progress of the work. Contractor shall submit a recovery

schedule in the event his work falls behind the approved construction schedule.

J. INSPECTION & TESTING

Contractor shall be responsible for maintaining the necessary licenses required for the completion of the work.

The Owner will pay for State assessed plan check fees and inspection fees, unless otherwise indicated.

Contractor and Subcontractor will be responsible for obtaining and paying for any required City Business licenses.

The on-site DSA Inspector will make normal building and code compliance inspections. Contractor will be responsible for compliance with all requirements of applicable codes per the Contract Documents. Contractor shall inform the Construction Manager at least 2 working days prior to scheduling required inspections. Use Inspection Request Form supplied in the appendix of this manual and also complete and submit the required DSA Form 156.

Inspection, testing, and sampling will be performed as specified in the General Conditions and the specific divisions of the Contract Documents. The Owner, through the Construction Manager, will contract for performance of soil, concrete, steel, grout and mortar testing. Review the Contract Documents for Contractor testing and sampling requirements. In all cases where testing is being performed of samples being taken, the Construction Manager will be given notification pursuant to Contract Document requirements. Contractor shall also timely request special inspections as required by DSA and complete and submit the required DSA verified report forms.

If inspection or testing discloses errors, omissions, inconsistencies, or deficiencies during construction activities, the Contractor will be immediately notified using the "Notice of Non-Conforming Work" form. If corrective action is not apparent, the Construction Manager may request the Contractor to propose a corrective action plan.

Where utilities (electric, water, drainage, sewer, gas, etc.) must be disrupted by construction activity, each Contractor shall notify the Construction Manager in writing at least fourteen (14) calendar days prior to the disruption, to be reflected on the 2 Week Look Ahead Schedule.

All **INSPECTION REQUESTS** will be channeled through the Construction Manager to the DSA Inspector (PI). The Construction Manager shall log and monitor time, date and subject of all Inspection Requests utilizing an Inspection Log, and maintaining a binder additionally containing copies of above completed form, as well as copies of Inspection Request Response form executed by the PI. Photographs of area or items to be inspected will be taken and kept as part of the permanent daily record of the project. Inspection log must indicate the title/number of the photos and their permanent file location.

K. VERIFIED REPORTS are required.

Each Contractor shall submit the required DSA Verified Reports to the Construction Manager at the end of construction or as otherwise required by DSA.

Three (3) copies of the report with **Blue ink wet signatures** shall be submitted. Retention may not be paid if Verified Reports are not received. The Construction Manager will transmit the completed Verified Reports to the Inspector for transmittal to DSA and the Architect. Use DSA-6 form supplied in appendix or any updated form from DSA at the completion of the project. The Contractor is also required to submit any other required DSA Verified Reports during construction of the project as required by DSA.

L. SAFETY

Contractor shall have sole and complete responsibility for initiating, maintaining and supervising all safety precautions and programs in connection with this Project. In no case shall the Owner, the Construction Manager, the Architect, the Inspector or their agents, employees or representatives, have either direct or indirect responsibility for the means, methods, techniques, sequences or procedures utilized by the Contractor, or for safety precautions and programs in connection with the work.

Contractor will provide the Construction Manager a copy of his updated safety program prior to commencing the work.

Contractor must submit a Safety Plan to the District via the Construction Manager within thirty five (35) calendar days of the issuance of the Notice to Proceed per the General Conditions (Specification 00 72 00). Contractor will conform to all OCIP Regulations **where applicable**.

M. CHANGE ORDER AND ALLOWANCE USAGE PROCEDURE
(Specification Section 00 72 00 Article 9)

The Owner, through the Construction Manager, may from time to time direct the Contractor to make changes in the work within the general scope of the Contract. All changes to the Contract will be implemented through written orders or directives prepared by the A/E and issued by the Construction Manager.

When the Construction Manager believes a change order to the construction documents is required that may involve a change in time or cost, he will request the A/E prepare a Bulletin and issue it to the Construction Manager. The A/E will sequentially number and date each Bulletin. The Construction Manager will attach an Allowance Usage Request (AUR) or Potential Change Order (PCO) form to the Bulletin requesting the Contractor to submit a proposal. The Proposal will fully describe the proposed change(s) to the Contract Documents, including sketches, new drawings, or revised specifications as required. The Construction Manager will maintain a log of all AUR/PCOs issued. The Construction Manager shall number each AUR/PCO. Sample AUR/PCO forms and work sheet are in the appendix.

Should the Contractor believe that conditions have changed or he has been directed to do additional work requiring a change in time or cost, he may request the Construction Manager to prepare a AUR/PCO delineating the changed condition along with the cost and/or time impact. If the Contractor intends to make claim for a change in the contract time or cost, he must give the Construction Manager written notice per contract documents after the occurrence of the event giving rise to the claim, or lose his rights to the cost recovery of the extra work arising from the claim.

Upon return of the AUR/PCO the Construction Manager will evaluate the Contractor's quotation for the work, using an estimate of time and cost impact prepared by the A/E or the Construction Manager. If the quotation is acceptable to the Construction Manager, the proposal will be forwarded to the Owner and the A/E. If the quotation is judged by the Construction Manager to be not acceptable, he will begin negotiations with the Contractor to come to an agreement as to the time and cost impact.

The Construction Manager reserves the sole right to notify the Contractor when there will be no further negotiations, and when an impasse exists between the Contractor and the Construction Manager and the work is declared to be in dispute.

The Owner and the Architect may issue through the Construction Manager an AUR/PCO which directs the Contractor to proceed with a change which will be included on a subsequent Change Order. The routing procedure will be the same as a change order. If the AUR/PCO directs work to proceed

prior to agreement on a lump sum quotation, the Contractor shall prepare an Extra Work Report **each day** for signature by the Construction Manager and/or the Inspector. **Extra Work tickets not signed daily will not be paid for.**

The DSA and Architect must approve all Change Orders. The Construction Manager will review each Allowance Usage Request or Proposed Change Order with the A/E to determine the appropriate DSA approval process and whether the Change Order is a Category A (DSA Form 140) or Category B (DSA Form 141) Construction Change Document. The Contractor must comply with all DSA requirements for Change Orders and Construction Change Documents.

N. APPLICATION FOR PAYMENT

Application for Payment shall be made by the Contractor on a **monthly** basis for work completed on or before the **25th of each month**.

All Applications for Payment shall contain the approved detailed Schedule of Values submitted by the Contractor at the time of award. Applications shall be submitted on forms provided in the appendix. **No other form will be accepted**.

No later than the 25th of each month, Contractor shall submit a "Preliminary Pay Request" (pencil copy) to the Construction Manager for review. Only the Schedule of Values need be submitted. The "Preliminary Pay Request" shall include a detailed Schedule of Values showing percentages of work complete or scheduled to be complete through the end of the month. The Construction Manager, the A/E and Inspector will review and evaluate the "Preliminary Pay Request". Upon agreement of the amounts due the Contractor, the Contractor will prepare the Application for Payment, and submit seven (7) original copies (wet signature) of the Application to the Construction Manager, last working day of the month, for signatures by the Architect and the Inspector. After signatures are obtained, the Construction Manager will submit the Applications to the District for payment. The District will process the Application.

Payment for materials delivered to the Project site but not yet incorporated in the work may be made, **at the discretion of the Owner**. Such materials must be stored at the Project site, properly stacked, crated, boxed, and, if necessary, covered and protected from weather. Documentation of cost shall be provided with the payment request for materials. No payment will be considered without the required documentation. See additional requirements in the General Conditions.

Change Orders, if applicable, shall not be billed until approval of school board is received.

EVERY pay application must be accompanied by a CONDITIONAL Lien Release for the current application, and an UNCONDITIONAL Lien Release for the prior application. All Applications and Releases are to be NOTARIZED, and signatures are to be in BLUE ink.

O. PAY ESTIMATE CHECK OFF PROCEDURE (INTERNAL)

1. Verify all Schedule of Values shown on second page agrees with Schedule of Values submitted by Contractor at start of Project.

2. Check all upper details, both pages, are correctly filled in, i.e. Contractor Name and Address, complete Project Name, Architect Name, pay period dates, and that contract date is shown. (Date of Contract Agreement.)

3. Verify all previous information is correctly transferred from last prior estimate. Verify all math calculations are correct on page two and the correct numbers are transferred to page one. Verify all math on estimate page #1.

4. Verify all approved Change Orders have been included in the estimate.

5. Verify Contractor signatures and notary signatures and stamp are on page #1.

6. Verify there is a Conditional Lien Release for the current payment request. If there has been a previous pay request, then verify there is also an Unconditional Lien Release for the previous estimate. These releases must be filled out and signed by the Contractor. The District will not pay if the releases are not in order.

7. Verify Preliminary Notice information against amounts billed and Request Lien Releases as necessary.

8. As-built drawings are updated and approved by PI.

9. Signed Verification of Certified Payroll Records Submittal to Labor Commissioner Form received.

10. OCIP clearance is obtained – no outstanding issues.

11. Once all of the above is correct, then transfer the complete original to the Construction Manager for signatures by the Architect and the PI. The Architect should be available for signatures, within a reasonable time.

12. After all signatures are obtained, CM signs as approved for payment, then copy for PCM3 file, attach a Letter of Transmittal and have Construction Manager take to district with spread sheet showing all estimates to date for signature by District and distribution to Accounting Department.

P. POSTING OF PROJECT DOCUMENTS (PLANS AND SPECIFICATIONS)

1. All Construction Managers will maintain an up-to-the-day posted set of plans and Specifications for each project at all times. This is essential to the continuity of the project during construction and for archiving purposes. This "Posted Set" shall not leave the Construction Trailer for any reason, and must be kept in a secure location and scrupulously maintained and preserved at all times.

2. Posting must be done within (24) twenty-four hours of the receipt of a completed, signed, change to the Contract Documents.

3. Items that must be posted:

    a. All addendums to the bid set

    b. All Requests for Information (RFI)

    c. All Instructional Bulletins (IB)

4. For consistency the following color scheme for posting shall be followed throughout the District:

    a. All pre-bid addendums to the bid set shall be posted on YELLOW paper.

    b. All RFI's will be posted using 50% reduction and PINK paper.

    c. All Instructional Bulletins will be posted using 50% reduction and GREEN paper.

5. All postings should be sufficiently clear and concise enough to indicate a definitive change to the bid documents. Postings that

implement changes on more than one plan sheet or specification page must be posted in the multiple locations or a reference to that posting must be made, sufficient to guide a user to a substantial and correct conclusion.

Note: Use of 50% reduction is a vehicle for saving space. All postings should be located on the plan sheet or in the Specification Section referred to in the posted document. If frequency of posting is such that more room is needed it is permissible to insert blank sheets into the plans or blank pages into the Specifications. Posting on the reverse of the preceding plan sheet is not advised due to the possibility of replacement sheets.

Q. ITEM OF CHANGE (IOC) LOG TO BE KEPT AND MAINTAINED BY CONSTRUCTION MANAGER.

1. All changes to the Contract Documents are to be logged under separate cover in an Items of Change (IOC) Log and maintained on a continual updated basis.

2. Items in the IOC Log must correspond to items included in the Schedule of Values and be valuated based on given costs or good faith estimates.

3. The IOC Log matrix should include, but be not limited to: Item Number; Date; Description; Budget Revision; checklist for necessary Approvals; and indication of Inclusion in a Change Order.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

COMPTON COMMUNITY COLLEGE DISTRICT
Daily Construction Job Report

School Site: CCC-055 Instructional Building 2

CONTRACTOR _____ ***DATE***

WEATHER _____ Time Work Started _____

SUPT./FOREMAN _____ Time Work Ended _____

WORK FORCE	Number of Hours					
WORKERS NAME	Foreman	Journeyman	Apprentice	Laborer	Operator	Other
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.						
13.					TOTAL	HOURS
14.						
15.						

WORK DONE and MATERIALS DELIVERED

COMPTON COMMUNITY COLLEGE DISTRICT
Construction Procedures Manual

SUBMITTAL FORM

CM #_____ (For CM Use Only)

CCCD Bond Trailer **PCM3, Inc.** **1111 E. Artesia Blvd.** **Compton, CA 90221**	**PROJECT: Instructional Bldg. 2** **PROJECT NO: RFQ CCC-055**

SUBMITTAL

_____
SUBMITTAL #

DATE: _____/____/____ **TITLE/Description: _____**

SPECIFICATION SECTION or DRWG. # :_____ **NO. COPIES SUBMITTED: _____**

NO. COPIES RETURNED: _____

TO: _____

DSA FILE NO: _____ CONTRACTOR: _____

ADDRESS: _____

DSA APP. NO: _____ PHONE: _____

ATTN.: _____

CONTRACTOR CERTIFIES: We have reviewed the attached submittal verifying products in this submittal, dimensions, adjacent work, and coordination of information is in accordance with the requirements of the work and contract documents, and approve this submittal (Reference Section 01330).

BY: _____ **DATE: _____/ _____ / _____**
Contractor's Representative

FOR USE BY ENGINEER: **ENGINEER'S STAMP:**

_____ NO EXCEPTIONS TAKEN

_____ MAKE CORRECTIONS NOTED

_____ REVISE & RESUBMIT

____ REJECTED

REMARKS:_____

_____

_____

COMPTON COMMUNITY COLLEGE DISTRICT
Construction Procedures Manual

SUBSTITUTION REQUEST FORM (AFTER BID)
Construction Manager #_____ (For CM Use Only)

DATE:_____ BID PACKAGE:_____

TO:_____

PROJECT: Instructional Bldg. 2
SPECIFIED ITEM:

_____
Section Page Paragraph Description

The undersigned requests consideration of the following:

PROPOSED SUBSTITUTION:_____

_____

_____

Attached data includes product description, specifications, drawings, photographs, performance and test data adequate for evaluation of the request. Applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents which the proposed substitution will require for its proper installation.

The undersigned certifies that the following paragraphs and any additional requirements in the General Conditions Article 3.10, unless modified by attachments, are correct:

1. The proposed substitution does not affect dimensions shown on drawings:
2. The undersigned will pay for changes to the building design, including engineering design, detailing, and construction costs caused by the requested substitution.
3. The proposed substitution will have no adverse affect on other trades, the construction schedule, or specified warranty requirements.
4. Maintenance and service parts will be locally available for the proposed substitution.
5. The proposed substitution is submitted within seven (7) calendar days after issuance of the Notice of Intent to Award.

The undersigned further states that the function, appearance, and quality of the proposed substitution are equivalent or superior to the specified item.

Submitted by: _____

Signature _____

Firm _____

Address _____

Remarks _____

Date _____

Telephone _____

Fax: _____ Date: _____

(For Use By The Design Consultant)

___ Accepted ___ Accepted as noted

___ Not Accepted ___ Received too late

Reviewed By _____

_____

_____

_____

COMPTON COMMUNITY COLLEGE DISTRICT

INSPECTION REQUEST

DATE:	**CONTRACTOR:**

SUB-CONTRACTOR/ TRADE: (if any)

DESCRIPTION OF REQUIRED INSPECTION:

INSPECTION LOCATION:	DATE REQUIRED:
	TIME REQUIRED:
PHONE:	

REQUESTED BY:	DATE:
TITLE:	SPECIAL INSTRUCTIONS:
SIGNATURE:	BATCH PLANT INSP. REQ'D: YES NO

INSPECTORS COMMENTS:	
DATE:	SIGNATURE:

SUBMIT TO (CM), 2 WORKING DAYS PRIOR TO DATE & TIME REQUIRED.

DATE & TIME RECEIVED BY **CM**:
CM. PROJECT MANAGER:

cc: CM File

COMPTON COMMUNITY COLLEGE DISTRICT
REQUEST FOR INFORMATION

PCM3 #_____ (For PCM3 Use Only)

(ALL LINE ITEMS MUST BE COMPLETED PRIOR TO SUBMITTAL)

RFI No.
_____ - _____
Bid Pkg. RFI No.

TO: Construction Manager **Ref No.:**

FROM: _____ **DWG. REF.:** _____

EMAIL _____

PROJECT: **RFQ CCC-055 Instructional Bldg. 2**

Spec. Ref: _____

Bid Pack: _____ **Date:** _____

Trade not BP No.

Description of Problem / Clarification / Information Required:

Drawings attached -

Proposed Solution:

Question By: _____ **Date:** _____

Response:

Response By: _____ **Date:** _____

Reviewed By: _____ **Date:** _____

COMPTON COMMUNITY COLLEGE DISTRICT

REQUEST FOR QUOTATION FORM

Project : RFQ CCC-055 Instructional Building 2

RFQ NO.:_____

DATE ____/____/____

TO:

_____

_____

_____

BID PACKAGE NO.:_____

Please submit price quotation for the following work:

_____

_____

_____

_____

_____

_____

_____

_____

_____

(Support Quotation with detailed cost breakdown and back-up materials.)

Reference Document, if any:_____

Price Quotation needed by:_____

Request submitted by:_____ DATE: ____/____/____

Construction Manager.

Parties agree and acknowledge the information in this Request for Quotation is for review purposes only. This Request for Quotation is not a request for, nor an authorization of additional work or an extension of the Contract period.

COMPTON COMMUNITY COLLEGE DISTRICT

ALLOWANCE USAGE REQUEST
CM #_____

PROJECT: RFQ CCC-055 Instructional Bldg. 2

ALLOWANCE USAGE REQUEST — AUR#_____

TO: _____ DATE ISSUED: _____

FROM: _____ PRICING DUE BY: _____

PROJECT No.: _____ PROJECT NAME: _____

Please submit an itemized quotation for change in the contract sum and time incidental to the proposed modifications to the Contract Documents as described herein. Cost breakdown format shall be as specified including all back up documentation.

Change Item: _____

THIS IS NOT A CHANGE ORDER NOR A DIRECTION TO PROCEED WITH THE WORK DESCRIBED HEREIN.
REFERENCE RFQ#_____DESCRIPTION OF AUR:

REQUESTED BY: A. [ ] Architect B. [ ] DSA Inspector C. [ ] Contractor D. [ ] Owner

COST IMPACT: A. [ ] NONE B. [ ] DEDUCT: $ _____ C. [ ] ADD: $ _____

TIME IMPACT: A. [ ] NONE B. [ ] DEDUCT _____ DAYS C. [ ] ADD: _____ DAYS
Submit justification for time impact per Article 9.5 in the General Conditions 00 72 00

APPROVAL OF THE AUR BY ALL PARTIES LISTED BELOW SERVES AS A NOTICE TO PROCEED.

cc: Contractor: BY: _____

District: BY: _____

Architect/Engineer BY: _____

Project Inspector BY: _____

Construction Manager BY: _____

COMPTON COMMUNITY COLLEGE DISTRICT

POTENTIAL CHANGE ORDER
CM #_____

PROJECT: CCC-055 Instructional Bldg. 2

POTENTIAL CHANGE ORDER — PCO#_____

TO: _____ DATE ISSUED: _____

FROM: _____ PRICING DUE BY: _____

PROJECT No.: _____ PROJECT NAME: _____

Please submit an itemized quotation for change in the contract sum and time incidental to the proposed modifications to the Contract Documents as described herein. Cost breakdown format shall be as specified including all back up documentation.

Change Item: _____

THIS IS NOT A CHANGE ORDER NOR A DIRECTION TO PROCEED WITH THE WORK DESCRIBED HEREIN.
REFERENCE RFQ#_____DESCRIPTION OF PCO:

REQUESTED BY: A. [ ] Architect B. [ ] DSA Inspector C. [ ] Contractor D. [ ] Owner

COST IMPACT: A. [ ] NONE B. [ ] DEDUCT: $ _____ C. [ ] ADD: $ _____

TIME IMPACT: A. [ ] NONE B. [ ] DEDUCT _____ DAYS C. [ ] ADD: _____ DAYS
Submit justification for time impact per Article 9.5 in the General Conditions 00 72 00

APPROVAL OF THE PCO BY ALL PARTIES LISTED BELOW SERVES AS A NOTICE TO PROCEED.

cc: Contractor: BY: _____

District: BY: _____

Architect/Engineer BY: _____

Project Inspector BY: _____

Construction Manager BY: _____

COMPTON COMMUNITY COLLEGE DISTRICT

Allowance Usage Request/Proposed Change Order
CHANGES AND EXTRAS FORM

The following format shall be used, as applicable by the District and the Contractor to communicate proposed additions and deductions to the Contract. A copy of the Allowance Usage Request and Proposed Change Order form is provided at the end of this Article.

		EXTRA	CREDIT
(a)	Material (attach itemized quantity and unit cost plus sales tax)	_____	_____
(b)	Labor (attach itemized hours and rates)	_____	_____
(c)	Equipment (attach invoices)	_____	_____
(d)	**Subtotal**	_____	_____
(e)	**For Proposed Change Order and Allowance Usage Request:** If Subcontractor performed Work, add Subcontractor's overhead and profit to portions performed by Sub-contractor, not to exceed fifteen percent (15%) of item (d).	_____	_____
(f)	**Subtotal**	_____	_____

		EXTRA	CREDIT
(g)	**For Proposed Change Order:** General Contractor's Overhead and Profit: Not to exceed fifteen percent (15%) of Item (d) if Contractor performed the work. No more than five percent (5%) of Item (f) if Subcontractor performed the work. If work was performed by Contractor and Subcontractors, portions performed by Contractor shall not exceed fifteen percent (15%) if Item (d), and portions performed by Subcontractor shall not exceed five percent (5%) of Item (f)		
	For Allowance Usage Request: Zero (-0-) percent markup per General Conditions Specification Section 00 73 00 paragraph H	_____	_____
(h)	**Subtotal**	_____	_____
(i)	**For Proposed Change Order:** Bond not to exceed one percent (1%) of Item (d)		
	For Allowance Usage Request: Zero (-0-) percent bond per General Conditions Specification Section 00 73 00 paragraph H.	_____	_____
(j)	**TOTAL**	_____	_____
(k)	Date / Time	_____	_____

The undersigned Contractor approves the foregoing Allowance Usage Request or Proposed Change Order as to the changes, if any, and the contract price specified for each item and as to the extension of time allowed, if any, for completion of the entire work on account of said Allowance Usage Request or Proposed Change Order, and agrees to furnish all labor, materials and service and perform all work necessary to complete any additional work specified therein, for the consideration stated herein. It is understood that said Allowance Usage Request or Proposed

Change Order shall be effective when approved by the Governing Board of the District.

It is expressly understood that the value of such extra Work or changes, as determined by any of the aforementioned methods, expressly includes any and all of the Contractor's costs and expenses, both direct and indirect, resulting from additional time required on the Project or resulting from delay to the Project. Any costs, expenses, damages or time extensions not included are deemed waived.

The Contractor expressly acknowledges and agrees that any change in the Work performed shall not be deemed to constitute a delay or other basis for claiming additional compensation based on theories including, but not limited to, acceleration, suspension or disruption to the Project.

INSTRUCTION SHEET

A. GENERAL INFORMATION:

The Payment Application and the Schedule of Values Sheet are designed to be used on a project where a Contractor has a direct Agreement with the Owner. **No Pay Applications will be accepted without updated approved "As-Builts".**

B. COMPLETING THE PAYMENT APPLICATION:

After the Contractor has completed the Schedule of Values Sheet, summary information should be transferred to the Payment Application.

The Contractor should sign the form have it notarized and submit it, together with the Schedule of Values, to the Architect. Seven signed, notarized originals should be submitted.

The Architect should review it and, if it is acceptable, complete the Architect's Certificate for Payment on this form. The completed form should be forwarded to the Owner.

C. COMPLETING THE SCHEDULE OF VALUES SHEET:

Heading: Complete the information here consistent with similar information on the Payment Application.

Columns A, B & C: These columns should be completed by identifying the various portions of the project and their scheduled value consistent with the schedule of values submitted to the Architect at the commencement of the Project or as subsequently adjusted. The breakdown may be by sections of the Work or by Subcontractors and should remain consistent throughout the Project. Multiple pages should be used when required.

Column C: This column should be subtotaled at the bottom when more than one page is used and totaled on the last page. Initially, this total should equal the original Contract Sum. The total of Column C may be adjusted by Change Orders during the Project.

Column D: Enter in this column the amount of completed Work covered by the previous application. This is the sum of columns D and E from the previous application. Values from column F (Materials Presently Stored) from prior payments should not be entered in this column.

Column E: Enter here the value of Work completed until the time of this Application, including the value of materials incorporated in the project, which were listed on the previous Application and Certificate for Payment under Materials Presently Stored (column F).

Column F: Enter here the value of Materials Presently Stored for which payment is sought. The total of the column ***must*** be recalculated at the end of each pay period. This value covers both materials newly stored for which payment is sought and materials previously stored which are not yet incorporated into the Project. Mere payments by the Owner for stored materials does not result in a deduction from this column. Only as materials are incorporated into the Project is their value deducted from this column and incorporated into column E (Work Completed—This Period).

Column G: Enter here the total of columns D, E and F. Calculate the percentage completed by dividing column G by column C.

Column H: Enter here the difference between column C (Scheduled Value) and column G (Total Completed and Stored to Date).

Column I: This column is normally used only for contracts where variable retainage is permitted on a line-item basis. It need not be completed on projects where a constant retainage is withheld from the overall contract amount.

Change Orders: Although Change Orders could be incorporated by changing the schedule of values each time a Change Order is added to the Project, this is not normally done. Usually, Change Orders are listed separately, either on their own form or at the end of the basic schedule. The amount of the original contract adjusted by Change Orders is to be entered in the appropriate location of the Payment Application.

D. MAKING PAYMENT

The Owner should make payment directly to the Contractor based on the amount certified by the Architect on the Payment Application. The completed form contains the name and address of the Contractor. Payment should not be made to any other party unless specifically indicated on this form.

APPLICATION AND CERTIFICATE FOR PAYMENT - AIA DOCUMENT G702/CMa (Instructions on next page) Page One of____Pages

TO: Compton Community College District
CCCD PCM3 Bond Trailer
1111 E. Artesia Blvd.
Compton , CA 90221

Instructional Bldg. 2

PERIOD TO: _____

APPLICATION NO. _____

Distribution to:
- ☐ OWNER
- ☐ ARCHITECT
- ☐ CONTRACTOR
- ☐ CONSTRUCTION MANAGER

FROM _____
ADDRESS _____

PROJECT NO: CCC-055

CONTRACT FOR: _____

BID PACKAGE:_____

CONTRACT DATE: _____

CONTRACTOR'S APPLICATION FOR PAYMENT

CHANGE ORDER SUMMARY			
Change Orders approved in previous months by Owner		ADDITIONS	DEDUCTIONS
TOTAL			
Approved this Month			
Number	Date Approved		
TOTALS			
Net change by Change Orders			

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates of Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

CONTRACTOR:
BY:_____ Date:_____

Application is made for Payments as shown below, in connection with the Contract. Schedule of Values is attached.

1. **ORIGINAL CONTRACT SUM** ..... _____
2. **NET CHANGE ORDERS**..... _____
3. **CONTRACT SUM TO DATE**..... _____
4. **TOTAL COMPLETED & STORED TO DATE**..... _____
   (Column G on SCHEDULE)
5. **RETAINAGE:**
   a.___5__ % Completed Work..... ..... _____
   (Column D + E on SCHEDULE) b.
   ___ % of Stored Material..... ..... _____
   (Column F on Schedule of Values Sheet Total Retainage (Line 5a + 5b or Total in Column 1 of Schedule of Values Sheet)..... ..... _____
6. **TOTAL EARNED LESS RETAINAGE**
   (Line 4 less line 5 Total)..... ..... _____
7. **LESS PREVIOUS CERTIFICATES FOR**
   PAYMENT (Line 6 from prior Certificate)..... ..... _____
8. **CURRENT PAYMENT DUE**..... ..... _____
9. **BALANCE TO FINISH, INCLUDING RETAINAGE..** _____
   (Line 3 less Line 6)

State of: ___ County of: _____
Subscribed and sworn to before me this _____day of _____ , 20____
Notary Public: _____
My Commission expires: _____

ARCHITECT'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based on-site observations and the data comprising this application, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED $ _____ Date: _____
(*Attach explanation if amount certified differs from the amount applied for)*

tBP

By: _____ Date:_____

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

By: _____ DATE: _____
INSPECTOR:
By: _____ DATE: _____
OWNER: Compton Community College District

BY: _____ DATE: _____
CONSTRUCTION MANAGER: PCM3, Inc.

APPLICATION FOR PAYMENT

SCHEDULE OF VALUES

Schedule of Values Sheet

Application and certificate for payment containing contractor's signed certification, is attached in tabulations below, amounts are stated to the nearest dollar.
Use column 1 on contracts where variable retainage for line items may apply

Application #	
Application Date	
Period To	
Project #	**CCC-055**

Contractor Name _____ BP # _____

A	B	C	D	E	F	G		H	I
			Work Completed						
Item #	**Description of Work**	**Scheduled Value**	**From Previous Application (D + E)**	**This Period**	**Materials Stored (Not in D or E)**	**Total Completed & Stored To Date (D +E+F)**	**% (G/C)**	**Balance To Finish (C-G)**	**Retainage (Of Variable Rate)**
1			-	$ -	$ -	$ -	#DIV/0!	$ -	$ -
2			-	$ -	$ -	$ -	#DIV/0!	$ -	$ -
3			-	$ -	$ -	$ -	#DIV/0!	$ -	$ -
4			-	$ -	$ -	$ -	#DIV/0!	$ -	$ -
5			-	$ -	$ -	$ -	#DIV/0!	$ -	$ -
6			-	$ -	$ -	$ -	#DIV/0!	$ -	$ -
7			-	$ -	$ -	$ -	#DIV/0!	$ -	$ -
8			-	$ -	$ -	$ -	#DIV/0!	$ -	$ -
9			-	$ -	$ -	$ -	#DIV/0!	$ -	$ -
10			-	$ -	$ -	$ -	#DIV/0!	$ -	$ -
11			-	$ -	$ -	$ -	#DIV/0!	$ -	$ -
12			-	$ -	$ -	$ -	#DIV/0!	$ -	$ -
13			-	$ -	$ -	$ -	#DIV/0!	$ -	$ -
14			-	$ -	$ -	$ -	#DIV/0!	$ -	$ -
Change Orders (Approved)									
Totals		**$ -**	**$ -**	**$ -**		**$ -**	#DIV/0!	**$ -**	**$ -**

COMPTON COMMUNITY COLLEGE DISTRICT

CONDITIONAL WAIVER AND RELEASE UPON PROGRESS PAYMENT
[Civil Code §8132)]

Upon receipt by the undersigned of a check from _____
(Maker of Check)
in the sum of $_____ Payable to _____
(Amount of Check) (Payee or Payees of Check)
and when the check has been properly endorsed and has been paid by the bank upon which it is drawn, this document shall become effective to release any mechanic's lien, stop notice or bond right the undersigned has on the job of Compton Community College District located at _____ to the following extent.

This release covers a progress payment for labor, services, equipment or materials furnished to _____ through _____
(Your Customer) (Date)
only and does not cover any retention retained before or after the release date; extras furnished before the release date for which payment has not been received; extras or items furnished after the release date. Rights based upon work performed or items furnished under a written change order which has been fully executed by the parties prior to the release date are covered by this release unless specifically reserved by the claimant in this release. This release of any mechanic's lien, stop notice, or bond right shall not otherwise affect the contract rights, including rights between parties to the contract based upon a rescission, abandonment, or breach of the contract, or the right to the undersigned to recover compensation for furnished labor, services, equipment, or material covered by this release if that furnished labor, services, equipment, or material was not compensated by the progress payment.

Before any recipient of this document relies on it, said party should verify evidence of payment to the undersigned.

Dated: _____ Company Name: _____

By: _____
(Title)

NOTE: This form complies with the requirements of Civil Code Section 8132. It is to be used by a party who applies for a progress payment when the progress check has not yet cleared the bank. This release only becomes effective when the check, properly endorsed, has cleared the bank.

USE REVERSE SIDE AS RELEASE FOR INDIVIDUALS PERFORMING LABOR FOR WAGES

§ 484(b) OF THE CALIFORNIA PENAL CODE PROVIDES IN PART AS FOLLOWS:

"Any person who receives money for the purpose of obtaining paying for services, labor, materials or equipment and willfully fails to apply such money for such purpose by wither willfully failing to complete the improvements for which funds were provided or willfully failing to pay for services, labor, materials or equipment provided incident to such construction, and wrongfully diverts the funds to a use other that for which the funds were received, shall be guilty of a public offense and punishable by a fine not exceeding ten thousand dollars ($10,000), or by imprisonment in the state prison, or in the county jail not exceeding one year, or by both such fine and such imprisonment. If the amount diverted is in excess of one thousand dollars ($1,000). If the amount diverted is less than one thousand dollars ($1,000), the person shall be guilty of a misdemeanor."

§484(c) OF THE CALIFORNIA PENAL CODE PROVIDES AS FOLLOWS:

"Any person who submits a false voucher to obtain construction loan funds and does not use the funds for the purpose for which the claim was submitted is guilty of embezzlement."

§206.5 OF THE CALIFORNIA LABOR CODE PROVIDES:

"No employer shall require the execution of any release of any claim or right on account of wages due, or become due, or made as an advance on wages top be earned, unless payment of such wages has been made. Any release required or executed in violation of the provisions of this section shall be null and void as between the employer and the employee and the violation of the provisions of this section shall be a misdemeanor."

§532(e) OF THE CALIFORNIA PENAL CODE PROVIDES AS FOLLOWS:

"Any person who receives money for the purpose of obtaining or paying for services, labor, materials or equipment incident to constructing improvements on real property and willfully rebates any part of the money to or on behalf of anyone contracting with such person for provision of the services, labor, materials or equipment for which the money was given, shall be guilty of a misdemeanor, provided**,** however, that normal trade discount for prompt payment shall not be considered a violation of this section."

COMPTON COMMUNITY COLLEGE DISTRICT

UNCONDITIONAL WAIVER AND RELEASE UPON PROGRESS PAYMENT

Civil Code Section 8134

The undersigned has been paid in and has received a progress payment in the sum of

$_____ for _____
(Amount of Check Written & Numeric)

labor, services, equipment, or material furnished to Compton Community College District on the job of CCCD _____Project and does hereby release pro tanto any mechanics lien, stop notice, or bond right that the undersigned has on the above referenced job to the following extent. This release covers a progress payment for labor, services, equipment, or material furnish to **Compton Community College District** through _____ only and does not cover any retention retained before of (Date/End of Month) after the release date; extras furnished before the release date for which payment has not been received; extras or items furnished after the release date. Rights based upon work performed or items furnished under a written change order which has been fully executed by the parties prior to the release date are covered by this release unless specifically reserved by the claimant in this release. This release of any mechanic's lien, stop notice, or bond right shall not otherwise affect the contact rights including rights between parties to the contract based upon a rescission, abandonment, or breach of the contract, of the right of the undersigned to recover compensation for furnished labor, services equipment, or material covered by this release if that furnished labor, services, equipment, or material was not compensated by the progress payment.

Date: _____

_____ _____
(Company Name) (Bid Package Number)

By: _____
(Signature)

_____ _____
(Print Name) (Title)

NOTICE: **THIS DOCUMENT WAIVES RIGHTS UNCONDITIONALLY AND STATES THAT YOU HAVE BEEN PAID FOR GIVING UP THOSE RIGHTS. THIS DOCUMENT IS ENFORCEABLE AGAINST YOU IF YOU SIGN IT, EVEN IF YOU HAVE NOT BEEN PAID. IF YOU HAVE NOT BEEN PAID, USE A CONDITIONAL RELEASE FORM.**

NOTE: This form of release complies with the requirements of Civil Code Section 8134. It is to be used to release claims to the extent that a progress payment has actually been received by the releasing party.

COMPTON COMMUNITY COLLEGE DISTRICT

CONDITIONAL WAIVER AND RELEASE UPON FINAL PAYMENT
(Civil Code Section 8136)

Upon receipt by the undersigned of a check from _____
(Maker of Check)

in the sum of $ _____
(Amount of Check)

payable to _____
(Payee or Payees of Check)

and when the check has been properly endorsed and has been paid by the bank upon which it is drawn, this document shall become effective to release pro tanto any mechanic's lien, stop notice or bond right the undersigned has on the job of Compton Community College District located at 1111 E. Artesia Blvd., Compton, CA 90221 to the following extent:

This release covers the final payment to the undersigned for all labor, services, equipment, or materials furnished on the _____, except for disputed claims for extra work in the amount of $_____.

DATED:_____ _____
(Company Name)

By: _____

_____
(Title)

NOTE: This form complies with the requirements of Civil Code Section 8136. It is to be used by the party who applies for a final payment when the final payment check has not yet cleared the bank. This release only becomes effective when the check, properly endorsed, has cleared the bank.

COMPTON COMMUNITY COLLEGE DISTRICT

2-WEEK-LOOK-AHEAD

1. Insert information, including dates
2. Include Contractor Company Name & Bid Package Number below
3. Include Signature below

Items to Schedule: _____

_____

Date: _____Signature: _____

Contractor:_____

COMPTON COMMUNITY COLLEGE DISTRICT

TIME AND MATERIAL WORK ITEM TICKET

PROJECT: _____ PCO/AUR#_____

CONTRACTOR: _____ SHEET# _____ of _____

Reference Document: _____ Submitted for work on: _____

Original Work Date for this Item: _____ Is Work Completed today? _____

Date of Last Work Activity: _____ Date Submitted to CM_____

WORK COMPLETED TODAY:

Location:

LABOR

EMPLOYEE NAME	CLASSIFICATION	Hours Noted	REMARKS
1._____	_____	_____	_____
2._____	_____	_____	_____
3._____	_____	_____	_____
4._____	_____	_____	_____
5._____	_____	_____	_____

MATERIAL

ITEM DESCRIPTION	QTY / UNITS	Hours Noted	REMARKS
1._____	_____	_____	_____
2._____	_____	_____	_____
3._____	_____	_____	_____
4._____	_____	_____	_____
5._____	_____	_____	_____

EQUIPMENT

EQUIPMENT	MAKE & MODEL	Hours Noted	REMARKS	Rented / Owned
1._____	_____	_____	_____	_____
2._____	_____	_____	_____	_____
3._____	_____	_____	_____	_____
4._____	_____	_____	_____	_____
5._____	_____	_____	_____	_____

CONTRACTOR CERTIFICATION: Signature by contractor to certify that all information on this sheet is true and accurate. Contractor also certifies that only the listed labor, material, and equipment listed were used for this item and that no other items are part of this work.	**SIGNATURES**
CM: Verifies hours worked as identified on this sheet only, not acceptance of any cost or schedule impact on behalf of the Owner.	
IOR: Verifies hours worked as identified on this sheet only, not acceptance of any cost or schedule impact on behalf of the Owner.	

UNCONDITIONAL WAIVER AND RELEASE UPON FINAL PAYMENT

{Civil Code Section 8138}

The undersigned has been paid in full for all labor, services, equipment or materials furnished to _____

on the job of _____

located at _____

and does hereby release pro tanto any mechanic's lien, stop notice or bond right, except for disputed claims for extra work in the amount of $_____.

DATED:_____ _____

Company Name

By:_____

Signature

Title _____

NOTICE: **THIS DOCUMENT WAIVES RIGHTS UNCONDITIONALLY AND STATES THAT YOU HAVE BEEN PAID FOR GIVING UP THOSE RIGHTS. THIS DOCUMENT IS ENFORCEABLE AGAINST YOU IF YOU SIGN IT, EVEN IF YOU HAVE NOT BEEN PAID. IF YOU HAVE NOT BEEN PAID, USE A CONDITIONAL RELEASE UPON FINAL PAYMENT FORM.**

NOTE: This form of release complies with the requirements of Civil Code Section 8138. It is to be used to release claims to the extent that a final payment has actually been received by the releasing party.

COMPTON COMMUNITY COLLEGE DISTRICT
1111 E. Artesia Blvd
Compton, California 90221

GUARANTEE

Guarantee for _____. We hereby guarantee that the _____, which we have installed in _____, has been done in accordance with the Contract Documents, including without limitation, the drawings and specifications, and that the work as installed will fulfill the requirements included in the bid documents. The undersigned and its surety agrees to repair or replace any or all such work, together with any other adjacent work, which may be displaced in connection with such replacement, that may prove to be defective in workmanship or material within a period of _____ (__) year(s) from the date of the Notice of Completion of the above-mentioned structure by the Compton Community College District, ordinary wear and tear and unusual abuse or neglect excepted.

In the event the undersigned or its Surety fails to comply with the above-mentioned conditions within a reasonable period of time, as determined by the District, but not later than ten (10) days after being notified in writing by the District or within two (2) business days in the case of an emergency or urgent matter, the undersigned and its surety authorizes the District to proceed to have said defects repaired and made good at the expense of the undersigned and its surety, who will pay the costs and charges therefore upon demand. The undersigned and its surety shall be jointly and severally liable for any costs arising from the District's enforcement of this Guarantee.

GUARANTEE (continued)

Contractor's Company Name

Signature of Contractor

Print Name

Title

Subcontractor's Company Name
(If work performed by subcontractor)

Signature of Subcontractor

Print Name

Title

Representatives to be contacted for service:

Name: _____

Address: _____

Telephone Number: _____

END OF SECTION

DSA 6-C

CONTRACTOR VERIFIED REPORT

This form shall be completed by each contractor having a contract with the owner, in accordance with California Code of Regulations, Title 24, Part 1, Sections 4-343 or 4-220.

School District/Owner:		DSA File #: -
Project Name/School:		DSA App. #: -
Date of Report:	Number of Attached Pages: (*If none, enter zero.*)	DSA 152 Card #(s):
Note that ***DSA approved*** construction documents, referred to below, are those portions of the construction documents, duly approved by the DSA, that contain information related to and affecting the Structural Safety, Fire/Life Safety and Accessibility portions of the project.		*List all inspection card numbers for which this verified report applies.*

COMPLETE SECTIONS 1, 2, 3 & 4 AND PROVIDE ALL REQUIRED DOCUMENTATION

1. CONTRACTOR INFORMATION *(Enter name and check applicable box)*

	Name of Contractor (Company/Firm) Submitting this Report:
☐	Operating as general contractor responsible for all work shown in the *DSA approved* construction documents.
☐	Operating as contractor responsible for part of the work shown in the *DSA approved* construction documents. (*Describe scope of work in the contract.)*

2. REASON FOR FILING THIS VERIFIED REPORT *(Check applicable box)*

☐	**Interim Verified Report:** List affected form DSA 152 Inspection Card Section #(s):
☐	**Final Verified Report:** Construction of all work shown in the *DSA approved* construction documents that is part of my contract is complete.
☐	**Termination of Contract** prior to completion of all work in the contract *(Provide last date of work)*:
☐	**DSA Request** Dated:

3. DEFERRED SUBMITTALS *(Check applicable box)*

☐	This project does not require deferred submittals within the scope of my contract.
☐	All deferred submittals within the scope of my contract are approved by DSA.
☐	The following deferred submittals, within the scope of my contract, are **not approved** by DSA *(Provide list. Attach additional pages if necessary.)*:

4. DEVIATIONS AS OF THE DATE OF THIS REPORT *(Check applicable box)*

☐	All deviation notices pertinent to my contract related to work shown in the *DSA approved* construction documents are resolved.
☐	There are unresolved deviation notices pertinent to my contract and related to work shown in the *DSA approved* construction documents. *(Attach copies)*
☐	There is work pertinent to my contract that is not completed in compliance with the *DSA approved* construction documents. *(Briefly describe. Attach additional pages if necessary.)*

I attest that based on my own personal knowledge (as defined in California Code of Regulations, Title 24, Part 1, Sections 4-336 and 4-214) that, except as marked in Sections 3 and 4, as of the date of this report, the work has been performed and materials have been used and installed, in every material respect, in compliance with the *DSA approved* construction documents. I declare under penalty of perjury that I prepared this report and that all statements are true.

Signature: _____ Date: _____

Print Name: _____ Contractor's License No.: _____

Submit completed form to the DSA Regional Office with construction oversight authority for the project.

☐ DSA OAKLAND	☐ DSA SACRAMENTO	☐ DSA LOS ANGELES	☐ DSA SAN DIEGO
1515 Clay Street, Suite 1201 Oakland, CA 94612	1102 Q Street, Suite 5200 Sacramento, CA 95811	700 N. Alameda Street, Suite 5-500 Los Angeles, CA 90012	10920 Via Frontera Rd., Suite 300 San Diego, CA 92127

V. PROJECT / CONTRACT COMPLETION

A. The contracts of certain other Contractors may be complete prior to the overall completion of the project, as determined by the Construction Manager. The entire project is not finally complete until Contractors have completed their work and all equipment and furnishings have been installed, systems tested, and accepted and all notices of completion recorded. The District may occupy all or any part of the project prior to completion, in accordance with the Contract Documents. See General Conditions Article 9.9 for further details regarding project completion and requirements.

END OF SECTION

V. APPENDIX

A. GENERAL FORMS:

1. Daily Construction Job Report
2. Submittal Form
3. Substitution Request Form
4. Inspection Request
5. Request For Information
6. Request For Quotation Form
7. Potential Change Order
8. Change and Extras Form
9. Instruction Sheet for Pay Applications
10. Application and Certification for Payment
11. Schedule of Values Sheet
12. Conditional Waiver And Release Upon Progress Payment
13. Unconditional Waiver And Release Upon Progress Payment
14. Conditional Waiver And Release Upon Final Payment
15. 2-Week-Look-Ahead
16. Time and Material Work Item Ticket
17. Guarantee Form
18. DSA-6 Form

COMPTON COMMUNITY COLLEGE DISTRICT

PROJECT COORDINATION

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED:

A. Each Prime CONTRACTOR shall coordinate his Work and Work of his subcontractors for the Project.

B. Each Prime Contractor shall:

1. Coordinate work of his own employees and suppliers.

2. Expedite his work to assure compliance with schedules.

3. Coordinate his work with that of other Prime Contractors, subcontractors, and work by DISTRICT.

C. Each Prime Contractor shall coordinate his work and the work of his subcontractors with other Prime Contractors on Project.

D. This Prime Contractor understands and will coordinate with Bid Packs 01to ensure proper coordination, scheduling and ensure that the required Fire Watch/Security is well informed and coordinated with the Construction Manager and reviewed at each construction meeting.

1.2 RELATED REQUIREMENTS:

A. The General Conditions of the Contract: Authority and responsibilities of the Contractor and subcontractor.

1.3 CONSTRUCTION ORGANIZATION AND START-UP:

A. The Prime Contractor shall establish on-site lines of authority and communications, and each Contractor shall:

1. Attend pre-construction meeting and mandatory weekly progress meetings.

2. Establish procedures for inter-project communications:

a. Submittals

b. Reports and records

c. Recommendations

d. Coordination drawings
e. Schedules (Critical path method, submitted to CONSTRUCTION MANAGER in accordance with the General Conditions)

f. Resolution of conflicts

3. Interpret Contract Documents:

a. Consult with CONSTRUCTION MANAGER to obtain interpretation from the ARCHITECT.

b. Assist in resolution of questions or conflicts which may arise.

c. Transmit written interpretations to subcontractors and to other concerned parties.

4. Assist in obtaining permits and approvals:

a. Building permits and special permits required for all Work or for temporary facilities.

b. Verify that subcontractors have obtained inspections for all Work through the D.S.A. approved INSPECTOR.

5. Control the use of site:

a. Supervise field engineering and site layout.

b. Allocate space for each subcontractor's use for field offices, sheds, and work and storage areas as approved by the CONSTRUCTION MANAGER.

c. Establish access, traffic and parking allocations and regulations.

d. Monitor use of site during construction.

1.4 GENERAL DUTIES:

A. Construction Schedules - Each Prime Contractor shall:

1. Prepare a detailed schedule of basic operations for all subcontractors.

a. Each subcontractor shall prepare sub-schedules to comply with critical phases.

2. Monitor schedules as work progresses:

a. Identify potential variances between scheduled and probable completion dates for each phase.

b. Recommend to CONSTRUCTION MANAGER adjustments in schedule to meet required completion dates.

c. Adjust schedules of subcontractors as required.

d. Document changes in schedule, submit to DISTRICT and ARCHITECT/ENGINEER through the CONSTRUCTION MANAGER and to involved subcontractors.

e. Upon written notice by CONSTRUCTION MANAGER, PRIME CONTRACTOR shall, within three (3) calendar days, provide a complete recovery schedule, including manpower loading, resource loading, detailing how the PRIME CONTRACTOR and his subcontractors will recover PRIME CONTRACTOR'S original scheduled milestone dates. Recovery schedule shall show overtime, weekends, or multiple shifts as necessary to meet each milestone of the original schedule.

3. Observe Work of each subcontractor to monitor compliance with schedule.

a. Verify that labor and equipment are adequate for the Work and the schedule.

b. Confirm that product procurement schedules are adequate.

c. Confirm that product deliveries are adequate to maintain schedule.

d. Report noncompliance to District D.S.A. approved INSPECTOR, with recommendation for changes.

B. Process Shop Drawings, product data and samples - Each Prime Contractor shall:

1. Prior to submittal to ARCHITECT/ENGINEER, review for compliance with Contract Documents:

a. Field dimensions and clearance dimensions.

b. Relation to available space.

c. Relation to other contracts and to other trades.

d. Effect of any changes on the Work of any other contracts or other trades.

e. Provide written approval that submittals have been approved by Prime Contractor.

C. Review coordination drawings prepared by mechanical and electrical Contractors - Each Prime Contractor shall:

1. Prior to submittal to ARCHITECT/ENGINEER, through the CONSTRUCTION MANAGER, review for compliance with Contract Documents.

2. Resolve conflicts and assure coordination of the Work of, or affected by, mechanical and electrical trades, or by special equipment requirements.

D. Inspection and testing - Each Prime Contractor shall:

1. Inspect Work to assure performance in accordance with requirements of Contract Documents.

2. Bring to ARCHITECT'S/ENGINEER'S attention, through the CONSTRUCTION MANAGER, the need of any special testing and inspections of suspect Work.

3. Reject Work which does not comply with requirements of Contract Documents.

4. Coordinate Testing Laboratory services:

a. Verify that required laboratory personnel are present.

b. Verify that tests are made in accordance with specified standards.

c. Review test reports for compliance with specified criteria.

d. Recommend and administer any required retesting.

E. Monitor the use of temporary utilities - Each Prime Contractor shall verify that adequate services are provided and maintained.

F. Monitor the PRIME CONTRACTOR'S periodic cleaning - Each Prime Contractor shall:

1. Enforce compliance with Specifications.

2. Resolve any conflicts.

G. Arrange for delivery of DISTRICT furnished products - Each Prime Contractor shall:

1. Inspect for condition at delivery.

2. Turn over to appropriate subcontractor, obtain receipt.

H. Changes and substitutions - Each Prime Contractor shall:

1. Recommend necessary or desirable changes to DISTRICT and to ARCHITECT/ENGINEER, through the CONSTRUCTION MANAGER.

2. Review subcontractor's requests for changes and substitutions. Submit recommendations to DISTRICT and to ARCHITECT/ENGINEER through the CONSTRUCTION MANAGER.

3. Assist ARCHITECT/ENGINEER, through the CONSTRUCTION MANAGER, in negotiating Change Orders.

4. Promptly notify all subcontractors of pending changes or substitutions.

1.5 CLOSE-OUT DUTIES:

A. Mechanical and electrical equipment start-up:

1. Coordinate check-out of utilities, operations systems, and equipment.

2. Assist in initial start-up and testing.

3. Record dates of start of operation of systems and equipment.

4. Submit to DISTRICT written notice of beginning of warranty period for equipment put into service.

B. At completion of Work of each Prime Contract, conduct an inspection to assure that:

1. Specified cleaning has been accomplished.

2. Temporary facilities have been removed from site.

C. Substantial Completion:

1. Conduct an inspection to confirm or supplement Prime Contractor's list of work to be completed or corrected.

2. Assist ARCHITECT/ENGINEER, through the CONSTRUCTION MANAGER, in preparation of correction list.

3. Supervise correction and completion of Work as established in Certificate of Substantial Completion.

D. When DISTRICT occupies a portion of Project prior to final completion, coordinate established responsibilities of PRIME CONTRACTOR and DISTRICT.

E. Final Completion:

1. When each Prime Contractor determines that Work is finally complete, conduct an inspection to verify completion of Work, prior to Punchlist.

2. Assist ARCHITECT/ENGINEER, through the CONSTRUCTION MANAGER, in verification of final completion.

F. Administration of Contract Close-out: - Each Prime Contractor shall:

1. Review final submittals and as-builts prior to transmittal.

2. Transmit to ARCHITECT/ENGINEER, through the CONSTRUCTION MANAGER, with recommendations for action.

1.6 REQUEST FOR INFORMATION

A. Each Prime Contractor shall plan, schedule, coordinate and sequence Work so Requests for Information (RFI), if necessary, may be submitted to the Architect/Engineer in a timely manner so as not to delay progress of Work. Submission of and responses to RFI(s) with copies to Owner, shall be transmitted via facsimile (FAX) equipment or via email to designated email addresses.

B. Telephone conversations requesting information shall be confirmed in writing for prompt reply of all RFI(s). Prime Contractor shall coordinate the timing of facsimile (FAX), email and telephone conversations to be made with the Architect's/Engineer's office between the hours of 8:00 a.m. and noon, Monday through Friday.

C. Architect/Engineer shall have the same time period to respond to RFI(s) as "shop drawing review period". When Architect/Engineer responds to an RFI within 5 working days after receipt of RFI but when the response already is contained or included within contract documents, or is based on referenced standards, or is based on established and common construction practices, Contractor shall reimburse the Architect at the following hourly rates:

Principal	$150
Associate Architect/Project Manager	100
Project Architect/Engineer	85
Job Captain	70
Draftsperson	65
Support Staff	45

If RFI requires Architect's/Engineer's Consultant(s) acknowledgement, Prime Contractor shall reimburse consultant(s), at the same hourly rate for consultant's staff; Prime Contractor shall also pay to the Architect, a percentage for overhead and profit to the consultant's fee, equal to the markup the Prime Contractor adds to "Change Orders".

D. Prime Contractor shall be billed at "Request for Payment" meeting, and payment is due on the 10th day of the following month. If payment is not received by Architect/Engineer by that date,

Architect's/Engineer's response to pending RFIs will be delayed by the same number of days as the days the payment check for RFI services is late.

E. No damages for delay due to RFI response beyond allotted time will be allowed, unless Contractor can show that RFI was not foreseeable with proper planning, scheduling, coordination, and sequencing, and the Architect's/Engineer's late response delayed timely purchase or delivery of equipment or material, or limited construction personnel from proceeding with their task(s), within previously listed "Construction Schedule" activity period(s).

1.7 QUALITY ASSURANCE

A. Familiarity with Contract Documents:

1. Prime Contractor and all Subcontractors shall conduct a study necessary to become completely familiar with all requirements. Applicable requirements indicated or described in the Contract Documents, and the publications referred to, are a part of the Work required as though repeated in each such Section.

2. In the event discrepancies or conflicts are encountered, notify the Architect/Engineer immediately. Where there is discrepancy between different parts of the contract documents, including referenced codes and standards, the documents requiring the higher quality, the greater quantity, or the more difficult work shall govern, unless determined otherwise by the Architect.

3. Promptly distribute required information to entities concerned and ensure the needed actions are taken.

B. Reporting: Unless otherwise noted by the Prime Contractor in his transmittals, all of the Prime Contractor's data transmittals to the Architect/Engineer for the Architect's/Engineer's review will be construed as stipulating that the Prime Contractor has thoroughly and completely reviewed and coordinated the data prior to transmittal.

C. Interfacing: It shall be solely the responsibility of each Prime Contractor to make sure that the assigned work completes in a timely manner and that all interfaces are prepared, connected, and function as required.

PART 2 – PRODUCTS – All products will be submitted and approved by the Architect/Engineer prior to purchase and then placement.

PART 3 - EXECUTION

3.1 PLANNING THE WORK

A. By thorough advance planning of activities, coordinate the following in addition to other coordination activities required:

1. Materials, services, and equipment purchasing.

2. Shipping.

3. Receipt and storage at the site.

4. Installation, including interface with related items.

5. Inspection and testing, to the extent required under the Contract.

6. Assistance in initial start-up and operational tests.

7. Completion of the Work, including removal and disposal of Contractor's surplus material and equipment, and final cleaning of structures and sites.

3.2 COORDINATION

A. Coordinate construction activities included under various Sections of these Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections of the Specifications that are dependent upon each other for proper installation connection and operation.

B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work.

3.3 GENERAL INSTALLATION PROVISIONS

A. Coordination methods used by the Prime Contractor are at the Prime Contractor's option, except that the Architect/Engineer may disapprove Work completed by the Prime Contractor or data

submitted by the Prime Contractor when, in the Architect's/Engineer's judgment, coordination has been inadequate to ensure the specified quality.

B. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Architect for final decision.

END OF SECTION

SECTION 013132 - IMPORT MATERIALS TESTING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies the requirements for the sampling, testing, transportation and certification of imported fill materials to school sites.

B. This Specification defines:

1. CONTRACTOR requirements for use of imported materials on project sites.

2. CONTRACTOR requirements for stockpiling materials for use on project sites.

3. Testing requirements for all materials imported, stockpiled or generated for use on a project site.

4. CONTRACTOR testing and reporting requirements.

5. CONTRACTOR submittal requirements

C. Provisions of the General Conditions and Division 01 apply to this section.

1.02 OBJECTIVES

A. Ensure that fill materials imported to project sites are safe for students, staff and visitors.

B. Ensure that representative data be collected so that analytical determinations can be made in regard to the first objective.

C. Require CONTRACTOR to contract with and pay for the services of a licensed environmental professional (licensed State of California Professional Engineer [PE Civil], Professional Geologist [PG] or Registered Environmental Assessor II [REA II]) familiar with environmental site assessment and waste classification.

D. Require CONTRACTOR to contract with and pay for an independent, approved California Department of Health Services certified testing laboratory to perform sampling and testing of imported and site generated fill materials.

E. Require CONTRACTOR to pay all fees required by authorities having jurisdiction over area.

F. Require CONTRACTOR to post bonds required by authorities having jurisdiction over area.

1.03 SUBMITTALS

A. CONTRACTOR shall submit to OWNER'S Authorized Representative (OAR):

1. A qualifications statement for CONTRACTOR's independent California certified testing laboratory and required licensed environmental professional (California Professional Engineer [PE civil]), Professional Geologist [PG] or Registered Environmental Assessor II [REA II]) prior to the start of Work. CONTRACTOR's licensed environmental professional must

possess recent demonstrated environmental experience in soil sampling and waste classification.

a. Testing laboratory must be pre-approved by the Division of State Architect.

2. A draft import Sampling Strategy Plan (SSP) prepared by CONTRACTOR's licensed environmental professional for review and concurrence by the OAR. The objective of the SSP is to obtain representative sample data. The Draft SSP must be submitted at least 72 hours prior to all proposed import sampling activities.

   a. At a minimum, the Draft SSP shall include a site map which shows the location of the proposed import and the location and number of the proposed stockpile samples. The draft SSP shall also contain information pertaining to the total volume of the stockpile proposed for sampling and the rationale in support of the proposed sampling approach. Existing environmental documentation specific to the import site shall be utilized by the CONTRACTOR's environmental professional to support the proposed sampling approach and analytical method suite. For new project sites, this information would include a DTSC approved site investigation report, e.g., Preliminary Environmental Assessment (PEA). It is the responsibility of the CONTRACTOR to request this information in advance from the OAR if they do not already have access to a copy at the jobsite.

   b. Lacking this information or rationale, samples shall be analyzed for all analytical methods described in Section 3.01. Guidance for the minimum number of samples per stockpile volume is provided in Table 1 (supplemental samples may be required by the OAR if pothole stockpile sampling is utilized.). In addition, the draft SSP shall contain all necessary contact information for the import site and a proposed schedule for the sampling activities.

   c. To expedite the review process, the Draft SSP shall be submitted electronically to the OAR in MS WORD format.

   d. Upon revision of the draft SSP by the CONTRACTOR's licensed environmental professional and acceptance by the OAR, four revised copies of the final SSP will be provided to the OAR for distribution to OEHS and the project file.

3. A draft Certification/Sample Data Report prepared by CONTRACTOR's licensed environmental professional for review and concurrence. At a minimum the draft Certification/Sample Data Report shall contain:

   a. a site map showing the location of the stockpile and stockpile sample locations;

   b. a detailed discussion and evaluation of the laboratory results;

   c. a summary of findings and recommendations that provide a determination on the waste classification of the subject materials, based on the representative sample results;

   d. recommendations for additional steps, if any;

   e. a chain-of-custody forms and all laboratory data with respective QA/QC sheets.

   f. To expedite the review process, the Draft SSP shall be submitted electronically to the OAR in MS WORD format.

g. Upon revision of the draft Certification Report by the CONTRACTOR'S licensed environmental professional and acceptance by the OAR, three copies of the final report will be submitted to the OAR.

4. The Environmental Compliance Manager shall confirm that the proposed waste classification for the proposed import material is appropriate.

5. Written documentation, in the form of a memo or e-mail from CONTRACTOR to OAR, prior to import, verifying that the hauling contract specifies "clean" trucks and that the actual haul trucks utilized for import activities will be clean of visible contamination or deleterious materials.

6. Written documentation that the trucks went directly from the source location to the recipient location with no detours or stops at other locations and that short loads were not augmented by other materials that were not tested as part of the final import SSP. It is the CONTRACTOR's responsibility to document that no other trips or short-load augmentation occurred and submit to the documentation within five (5) business days of the completion of the import activities. All import transportation activities shall be conducted in accordance with all applicable (local, State, Federal) rules and regulations.

7. The independent approved testing laboratory shall perform the required tests and report results of all tests noting if the tested material passed or failed such tests and shall furnish copies to the IOR, Architect, OAR, DSA, Contractor, and others as required. Report shall state tests were conducted under the responsible charge of a licensed State of California professional engineer and the material was tested in accordance with applicable provisions of the Contract Documents, Title 24, CCR and the DSA. Upon completion of the Work of this section, the independent testing laboratory and geotechnical engineer shall submit a verified report to DSA as required by Title 24, CCR.

8. Certification, in the form of haul tickets or completed waste manifests, documenting the volume and recipient of all import materials and activities. This documentation shall be coordinated through the OAR Environmental Compliance Manager.

   a. For approved import to new project sites, unregulated facilities (landfill) or non-project sites, haul tickets may be utilized, but shall contain the following minimum information:

      1) date of haul activity

      2) address of source

      3) address of recipient

      4) load volume

      5) time of departure from source

      6) time of arrival at recipient site

      7) signature of recipient or recipient's agent

1.04 APPROVALS

A. NO import of earth or geotechnical grading or fill materials can occur at the project site without PRIOR approval by the OAR.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Imported

1. Soils: Soils proposed for import shall be tested pursuant to the requirements of this Section.

2. Gravels: Clean gravel, consisting of native rock from a commercial source, shall be tested pursuant to the requirements of this Section. Refer to Item 2.01.B, this Section, for the list of pre-tested sites

3. Sands: Clean sand from a commercial source shall be tested pursuant to the requirements of this Section. CONTRACTOR shall provide written documentation, which identifies the source, volume and proposed transport date(s) of the material for review. Refer to Item 2.01.B, this Section, for the list of pre-tested sites:

4. Miscellaneous Material: No miscellaneous material containing crushed concrete, asphalt, construction debris, or other potential deleterious materials may be utilized or imported to the project site for use as fill or grading material.

B. Pre-Tested Sites:

Vulcan Materials Company
1709 Sherbon Street
Corona, CA 92879
Materials Tested: Sand, CAB, and 3/4 " Rock

LB Crushing Company
3100 Horseless Carriage Road
Norco, CA
Materials Tested: Sand

El Toro Materials
Rocky Road & Portola Parkway
Lake Forest, CA
Materials Tested: Sand

Hanson Aggregates North America-Inland Plant
12000 Banyan Street
Rancho Cucamonga CA 91730
Materials Tested: Sand

Hanson Aggregates North America-Irwindale
13550 Live Oak Avenue
Irwindale, CA 91706
Materials Tested: Sand

Inland Empire Regional Composting Authority (IERCA)
12645 Sixth Street
Rancho Cucamonga, CA 91739
Materials Tested: Top Soil and Mulch

C. Import of fill Materials:

1. Fees: CONTRACTOR shall pay as required by authorities having jurisdiction over area.

2. Bonds: CONTRACTOR shall post as required by authorities having jurisdiction over area.

PART 3 - EXECUTION

3.01 GRADING/EXCAVATION

A. If the Contractor encounters an area(s) with discolored, stained, and/or odorous soils or any other evidence of contamination during excavation/grading work, Contractor must immediately notify District Representative, cease work in the aforementioned area(s), and secure the area(s) with fencing, tape, stakes or other suitable means to prevent entry by personnel or equipment. In turn, the District Representative which will initiate a construction response to address the contamination, in accordance with pertinent regulatory requirements.

3.02 SAMPLING AND TESTING

A. CONTRACTOR shall contract with, and pay for, the services of a licensed environmental professional (licensed State of California Professional Engineer [PE Civil], Professional Geologist [PG] or Registered Environmental Assessor II [REA II]).

B. CONTRACTOR shall contract with, and pay for, an independent, approved California Department of Health Services certified testing laboratory to perform sampling and testing of imported, exported and site generated fill materials. [Note: Utilization of portable, onsite crushing equipment on the project site also requires prior notification and approval by the OAR].

C. All imported fill/grading material, unless otherwise specified in writing by the OAR, must be tested at the site of origin. Import testing and certification process shall include the following steps:

1. Stockpile all materials for sampling (standard stockpile or backhoe pothole stockpile). Crushed fill materials generated by CONTRACTOR at a project site must be segregated by material (e.g., separate stockpiles for concrete, asphalt, etc.).

2. Submit Draft SSP for review and concurrence by OAR.

3. Collect and analyze samples (see Table 1 for number of samples per volume) per SSP. Once fill materials for export have been stockpiled and tested, they may not be used onsite for any purpose without prior approval by the OAR.

4. Submit draft import sample data report for review and concurrence by the OAR.

5. Submit final import sample data report (Certification Report) to the OAR's Environmental Compliance Manager for concurrence of proposed waste classification.

6. Submit required pre import documentation/record to the OAR (e-mail).

7. Submit post import certifications to the OAR.

8. In addition to the preceding, requirements, certifications and submittals as indicated in previous subsections above.

D. OWNER retains the right to refuse any fill material proposed for use at a project site.

E. Import fill materials shall be stockpiled by CONTRACTOR and are deemed acceptable for import or reuse only when it is demonstrated to the satisfaction of the OAR's Environmental Compliance Manager that the subject materials meet the requirements of this Section (01440).

F. As described in Section 1.03B, lacking site-specific data or sample rationale to support a more focused analytical approach; the CONTRACTOR shall analyze all samples for the following substances according to the methods indicated below. Table 3 is a waste classification flowchart for use by CONTRACTOR's environmental professional. In all cases, detection levels and quality assurance/quality control methods shall be in accordance with standard Method reporting limits and best laboratory practices and the following USEPA (EPA) methods:

1. Total Petroleum Hydrocarbons, utilizing EPA Method 8015M, for gasoline and diesel.
2. Volatile Organic Compounds, utilizing EPA Method 8260B/5035.
3. Polychlorinated biphenyls, utilizing EPA Method 8082.
4. Semi-Volatile Compounds, utilizing EPA Method 8270C.
5. Organochlorine Pesticides, utilizing EPA Method 8081A.
6. Organophosphorous Pesticides, utilizing EPA Method 8141A.
7. Chlorinated Herbicides, utilizing EPA Method 8151A.
8. California Code of Regulations Title 22 (CAM 17) Metals, utilizing EPA Method 6010B/7470A.
9. Hexavalent Chromium, utilizing EPA Method 7199.
10. Arsenic/Thallium, utilizing EPA Method 6020.

G. Import fill material may be deemed defective for use by the OAR at the project site if any of the following results are obtained:

1. Total Petroleum Hydrocarbons are present at concentrations exceeding 100 milligrams per kilogram (mg/kg) for gasoline and 1,000 mg/kg for oil/diesel and long chain hydrocarbons.
2. Solvents and other volatile organic compounds are present at concentrations exceeding the laboratory reporting limit.
3. Polychlorinated biphenyls are present at concentrations exceeding the laboratory reporting limit.
4. Semi-volatile compounds are present at concentrations exceeding the laboratory reporting limit.
5. Organochlorine pesticides are present at concentrations exceeding the laboratory reporting limit.
6. Organophosphorous pesticides are present at concentrations exceeding the laboratory reporting limit.
7. Chlorinated herbicides are present at concentrations exceeding the laboratory reporting limit.

8. California Code of Regulations Title 22 (CAM 17) Metals at concentrations exceeding site-specific background.

9. Hexavalent chromium is present at concentrations exceeding 15 mg/kg.

H. In addition to screening for hazardous materials, the imported soil must be tested and certified to be free of:

1. Organics and debris;

2. Infestation by vermin or insects, in particular fire ants;

3. Boron.

I. Imported materials must be suitable for engineered fill, even if used at landscaping, free from large rocks.

J. Imported materials shall not have a high clay content and must meet the permeability requirements of the projects hardscape if there is such requirement.

K. Evaluate concentrations of metals in import fill by conducting the analysis set forth below.

1. Compare the maximum detected metal concentrations in import fill samples to the Threshold Criteria listed in Table 4. If any metal concentration exceeds its listed background value, the fill material fails and shall be deemed defective and unacceptable for use at the project site unless supported by a site specific health risk assessment.

2. In addition to section 3.01.G.1, import fill shall be deemed environmentally defective and unacceptable for use if any of the following results are obtained:

a. Arsenic concentrations exceed 12.0 mg/kg.

b. Lead concentration exceeds 255 mg/kg or fails TTLC/STLC.

c. Import materials at new project sites with total chromium concentrations greater than or equal to 100 mg/kg shall be tested for hexavalent chromium.

L. All import fill material shall be characterized, handled, and documented in accordance with applicable US EPA and State of California hazardous waste and hazardous materials regulations (See Table 2). For the purpose of this specification, “contaminated” shall mean any soil or geotechnical material at a concentration, which would require disposal at a regulated facility (i.e., California hazardous or RCRA hazardous). OAR must be notified at least 72 hours prior to the disposal of any hazardous waste or hazardous material. No material disposal or reuse can take place without prior written approval of the OAR.

M. Specification test results and OAR approvals shall be valid for a period of 120 days from the date of the subject testing unless a variance is requested by CONTRACTOR and approved by OAR. Previously approved materials shall not be utilized or disposed offsite after the 120 day limit without prior review and approval by the OAR.

N. Requests for variances to this Specification shall be submitted in writing to the OAR a minimum of two weeks in advance of need for review and approval. The request for variance must provide all available testing data, a rationale to support the request and have an active funding line (provided by OAR) to facilitate review by the OAR. OAR will review the request for variance and will provide its

preliminary determination within two weeks. Certain requests may require final approval by the Department of Toxic Substances Control (DTSC).

O. Soils with concentrations above Section 01440 screening levels may, upon prior approval by the OAR, may be reused at other project sites if supported by a site-specific human health risk assessment.

P. Details of the samples and testing must be submitted to and approved by the OAR's Environmental Compliance Manager before transportation.

Q. Haul Routes and Regulations/Restrictions: CONTRACTOR must comply with requirements of project EIR (CEQA) and authorities having jurisdiction over the project area and the proposed activities (e.g. Regional Water Quality Control Board, Department of Toxic Substances Control, etc.).

3.03 TRANSPORTATION

A. CONTRACTOR shall pay all fees required by authorities having jurisdiction over area.

B. Contractor shall pay all fees for disposal and/or processing of contaminated and/or hazardous fill materials at a regulated facility.

C. CONTRACTOR shall post and pay for all bonds required by authorities having jurisdiction over area.

TABLE 1: MINIMUM SAMPLING FREQUENCY

Volume (Cubic Yards)	Sampling Frequency
0 – 1,000	1 per 250 CY
1,001 - 5,000	4 samples per first 1,000 CY and 1 sample per each additional 500 CY
Greater then 5,000	12 samples for first 5000 CY and 1 sample per each additional 1,000 CY

Chemicals of Potential Concern	TABLE 2 WASTE CHARACTERIZATION				
	Hazardous Waste if Exceed Criteria - TTLC Level* (mg/kg)	Additional WET Leaching Tests if Exceed Hazardous Waste Criteria - 10 times STLC Level** (mg/kg)	California-Regulated Hazardous Waste - Soluble Threshold Limit Concentration -STLC Level (mg/l)	Additional TCLP Leaching Tests if Exceed Hazardous Waste Criteria - 20 times TCLP Level** (mg/kg)	Federally-Regulated (RCRA) Hazardous Waste - Toxicity Characteristic Leaching Procedure - TCLP Level (mg/l)
CAM 17 Metals					
Antimony	500	150	15	NA	NA
Arsenic	500	50	5	100	5
Barium	10,000	1,000	100	2,000	100
Beryllium	75	7.5	0.75	NA	NA
Cadmium	100	10	1	20	1
Chromium	2,500	50	5	100	5
Cobalt	8,000	800	80	NA	NA
Copper	2,500	250	25	NA	NA
Lead	1,000	50	5	100	5
Mercury	20	2	0.2	4	0.2
Molybdenum	3,500	3,500	350	NA	NA
Nickel	2,000	200	20	NA	NA
Selenium	100	10	1	20	1
Silver	500	50	5	100	5
Thallium	700	70	7	NA	NA
Vanadium	2,400	240	24	NA	NA
Zinc	5,000	2,500	250	NA	NA
Chromium (VI)	500	50	5	NA	NA

TABLE 3 – WASTE CLASSIFICATION FLOWCHART

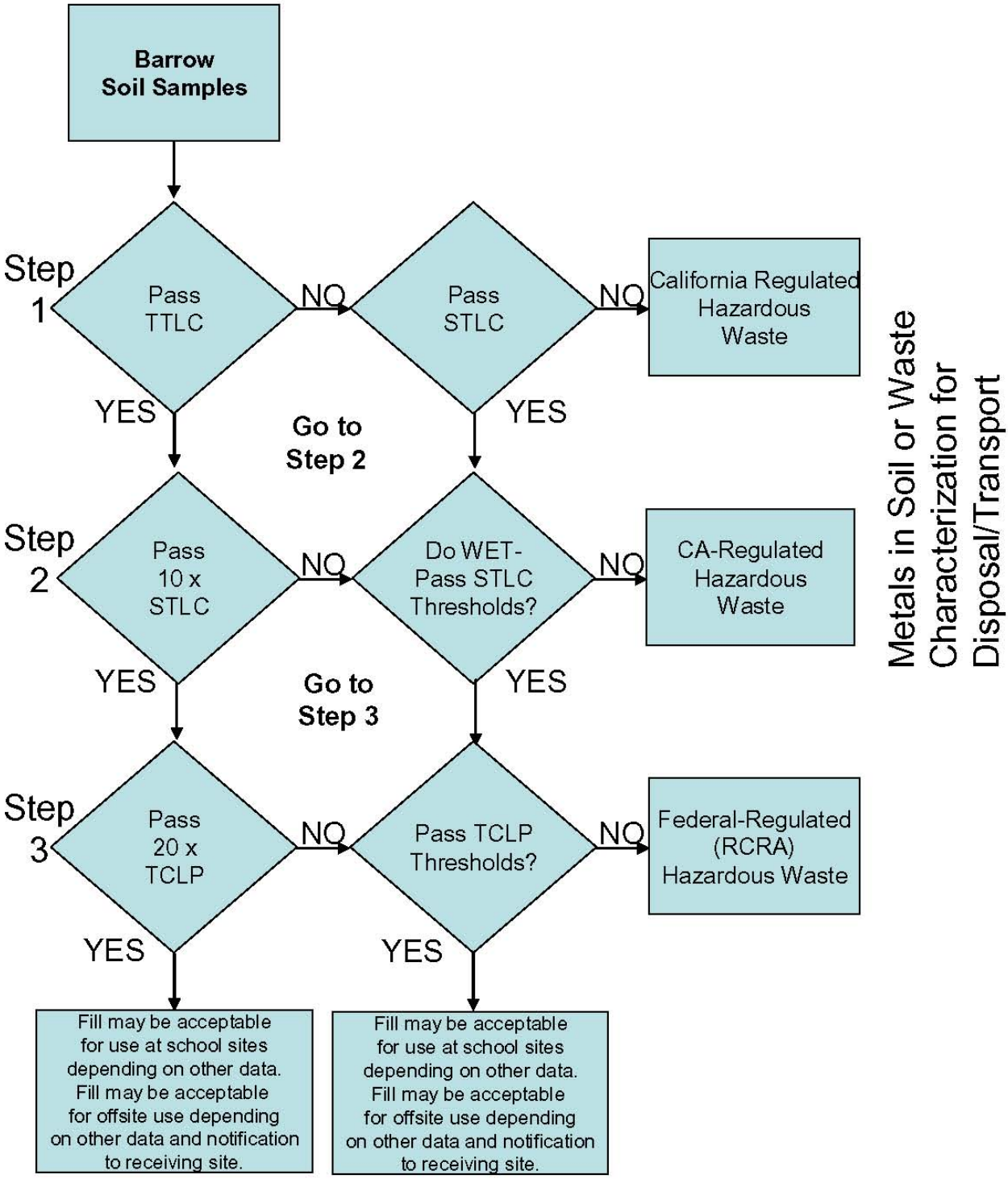


TABLE 4: THRESHOLD CRITERIA FOR METALS IN SOIL - LOOK UP VALUES

CAM 17 Metals	Soil Threshold Criteria (mg/kg)	Basis
Antimony	28	NC
Arsenic	11.3	BK
Barium	2330	NC
Beryllium	16	C
Cadmium	1.4	C
Chromium	106656	NC
Cobalt	4266	NC
Copper	2631	NC
Lead	255	PbB
Mercury	21	NC
Molybdenum	356	NC
Nickel	148	C
Selenium	356	NC
Silver	356	NC
Thallium	4.7	NC
Vanadium	498	NC
Zinc	21331	NC

NC = noncancer health effects

BK = background

C = cancer risk

PbB = blood lead levels

END OF SECTION 013132

This page intentionally left blank.

COMPTON COMMUNITY COLLEGE DISTRICT

ACCELERATION OF WORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for the acceleration of the work by the Contractor.

1. Where work is falling behind the construction schedule and the total project may not be completed by the date for contract completion as adjusted by change orders.

2. Where the District requires the entire project or a portion thereof be completed at a date earlier than the contract completion date as adjusted by change orders.

B. Related Sections

1. Section 01 25 00 - Contract Modifications Procedures

2. Section 01 29 00 - Payment Procedures

3. Section 01 33 00 - Submittals.

C. Construction Completion date as stated in the Agreement shall be the completion dated as revised by all time extensions granted at the time acceleration of the work begins.

1.2 NOTICE TO ACCELERATE WORK

A. If in the judgment of the Architect and School District it becomes necessary at any time to accelerate the work or a portion thereof to increase rate of progress, Contractor when directed in writing, shall increase his construction forces, equipment, hours of work, number of shifts, delivery of materials and provide means to insure timely completion of the project.

1. Any increase in cost to Contractor to accelerate the work progress to meet construction schedules or contract completion dates are the responsibility of the Contractor.

2. Contractor shall not be entitled to additional compensation for additional effort he applies to the work to meet construction schedules or contract completion dates.

3. Overtime hours by Contractor or its Subcontractors are the responsibility of the Contractor and are not grounds for additional compensation.

B. If in the judgment of the Architect/Engineer and School District it become necessary at any time to accelerate the work or a portion thereof be completed at a date earlier than the contract completion date, Contractor when directed in writing, shall increase his construction forces, equipment, hours of work, number of shifts, delivery of materials and provide means to insure an earlier completion date.

1. Architect/Engineer and District shall determine new accelerated completion date.

2. Any increase in the cost to Contractor in compliance which such accelerated completion date shall be adjusted by Change Order.

C. All directives or orders to accelerate the work will be in writing. Any directive or order terminating acceleration of the work will be in writing.

D. Phased Construction: Where the project includes phased construction and portions of the project are to be completed at earlier times than other portions of the contract, the above stated acceleration provisions shall apply to each phase of the construction contract.

1.3 CONTRACTOR RESPONSIBILITIES

A. Contractor shall when so directed by the Architect/Engineer or School District to accelerate the work or portion thereof, deploy Subcontractors, accelerate material deliveries, increase work forces, increase hours of work, provide additional shifts or provide other methods to accelerate progress of the work.

B. Contractor shall within ten (10) calendar days after receiving written notice to accelerate the work, provide in writing to the Architect/Engineer and District specific measures being taken or planned to increase rate of progress along with a revised Construction Schedule. Architect/Engineer may require the Contractor to make adjustments in the plan of action to insure acceleration of the work.

C. Contractor shall continue acceleration of the work until scheduled progress is regained for timely completion of the project. Timely completion shall be understood as the contract completion date, as revised by all time extensions granted at the time acceleration begins.

1.4 REVISED CONSTRUCTION SCHEDULE

A. Critical-Path Acceleration of Work Schedule: Prepare a new revised fully developed, Critical Path Method type Contractor's construction schedule showing an Acceleration of Work Schedule and new completion dates where an earlier completion date is directed. Revised schedule shall show acceleration of work scheduled to increase progress of the work to provide for timely completion of the project.

PART 2 – PRODUCTS - (Not Applicable)

PART 3 – EXECUTION - (Not Applicable)

END OF SECTION

This page intentionally left blank.

COMPTON COMMUNITY COLLEGE DISTRICT

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: General requirements for the submittal of Shop Drawings, product literature, samples, RFIs, and other data.

1. To ensure that specified products are furnished and installed in accordance with the design intent, procedures have been established for advance submittal of relevant data, and for review and acceptance or rejection of that data by the Architect.

2. Procedures have been established to ensure that Contractor requests for information and clarification are processed efficiently and promptly.

B. Referenced Documents and Sections:

1. Document 00 72 00 - General Conditions.

2. Section 01 45 00 - Quality Control.

3. Section 01 63 00 - Product Substitution Procedures.

C. Substitutions: Requests for substitutions shall be made in accordance with the provisions of, and in a form described in, Section 01 63 00.

1.2 DEFINITIONS

A. Request For Information (RFI): A document submitted by the Contractor requesting clarification of a portion of the Contract Documents, hereinafter referred to as RFI.

1. Proper RFI: An RFI that includes a detailed written statement indicating the specific Drawings or Specification section in need of clarification and the nature of the clarification requested.

B. Improper RFIs: RFIs that are not properly prepared.

1. Improperly prepared RFIs will be processed by the Architect/Engineer at the Architect's/Engineer's standard hourly rate. The Architect will charge the Owner, and such costs will be deducted from monies still due the Contractor.

    a. The Contractor will be notified by the Architect/Engineer prior to the processing of Improper RFIs.

C. Frivolous RFIs: RFIs that request information that is clearly shown on the Contract Documents.

1. Frivolous RFIs may be returned unprocessed. If processed, the Architect may charge the Owner at the Architect's/Engineer's standard hourly rate, and such costs will be deducted from monies due the Contractor.

    a. The Contractor will be notified by the Architect/Engineer prior to the processing of Frivolous RFIs.

1.3 SCHEDULE OF SUBMITTALS

A. Schedules: Furnish required schedules in accordance with the General Conditions listing all items that will be submitted for acceptance-review by the Construction Manager and Architect/Engineer.

1. Include Shop Drawings, manufacturer's literature, test procedures, test results, certificates of compliance, material samples, and special guaranties.

2. Indicate scheduled dates for submitting the above items, projected needs for responses, and procurement dates.

3. Revise and update submittal schedule as required to keep current. Make revised schedules available to the Architect/Engineer for review.

B. For drawings larger than 11 inches by 17 inches, submit two copies of blueline prints, and one reproducible sepia or vellum of each Shop Drawing submittal, or as determined by mutual agreement. One reproducible copy will be returned to Contractor for reproduction and distribution as required.

1. Alternately, provide two sets of plain bond paper copies 11 inches by 17 inches in size.

C. Make submittals in accordance with the General Conditions to allow adequate time for securing necessary acceptances, for revision and resubmittal, for placing orders and securing delivery, and to accommodate the rate of construction progress required under the Contract.

D. Do not begin work requiring submittals until the submittals have been returned with the other professional consultant's stamp indicating review and acceptance.

1. Provide acknowledgement stamp by Contractor signifying review and acceptance of submittal as defined in Article 1.5 - Coordination of Submittals.

E. Submittals with Bid:

1. Elevators: Provide copies of Preventive Maintenance Contract in accordance with Project Manual Elevator Specifications (if any).

1.4 IDENTIFICATION OF SUBMITTALS

A. On submittal forms acceptable to the Architect/Engineer, identify each submittal and resubmittal by including the following information:

1. Name and address of submitter, including name and telephone number of the individual to be contacted for further information.

2. Complete name of Project.

3. Drawing number and Specification Section number to which the submittal applies.

4. Whether submittal is an original or a resubmittal.

5. Date submittal was prepared or revised.

1.5 COORDINATION OF SUBMITTALS

A. General: Fully coordinate materials prior to submittal for review. Include a transmittal form with a signed statement that submittal satisfies the following procedures:

1. Determine and verify field dimensions and other field conditions.

2. Coordinate with work of related trades.

3. Coordinate with the requirements of public agencies having jurisdiction.

4. Secure required approvals from public agencies and signify by stamp, or other legitimate means, that they have been secured.

5. Indicate necessary deviations from the Contract Documents in a clear manner.

B. Grouping of Submittals: Make submittals in groups containing associated items. The Architect reserves the right to reject partial submittals as not complying with provisions of the Contract Documents.

PART 2 - PRODUCTS

2.1 PRODUCT DATA

A. When required by Part 1 - General of the respective Sections, submit manufacturer's printed product data and instructions for products used on the Project. Include catalog cuts, diagrams, and other descriptive material published by the manufacturer, as well as evidence of compliance with safety and performance standards to demonstrate conformance to the specified requirements. Catalog numbers alone will not be acceptable.

1. Include complete lists of materials, illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information proposed for use, giving manufacturer's name, catalog number, and catalog cut for each item, where applicable.

2. When materials, equipment, or fixtures are identified by numeric, alphabetical, or alphanumerical designations, identify materials, equipment, and fixtures proposed for use with identical designations.

2.2 SHOP DRAWINGS

A. When required by Part 1 - General of the respective Sections for the various portions of the construction, provide special detailed drawings, diagrams, schedules, and other data in amplification of the Contract Documents before proceeding with the work.

1. Refer to Document 00 72 00 - General Conditions for obligations under the Contract regarding Shop Drawings, product data, and samples.

B. Submit Shop Drawings prepared by qualified detailers. Identify details by reference to Contract Drawing sheet and detail numbers and by specification section and article numbers. Provide a blank area approximately 4 inches by 4 inches for Architect's review stamp.

1. Do not use reproductions of Contract Drawings for fabrication or erection drawings.

C. Shop Drawings submitted shall include not less than the following:

1. Dimensioned plans, elevations, and sections locating assembly components in relationship to each other and in relationship to contiguous building structure.

2. Typical and special fabrication and installation details, including details of anchorage to supporting structure.

3. Materials and finishes.

D. Indicate desired deviations from Contract Drawings on Shop Drawings by placing a heavy line around features on which acceptance is requested. Append a note to each deviation specifically requesting acceptance.

1. Contractor is advised that the identification of "desired deviations" will not be construed as a means of requesting substitutions. Make requests for substitutions in accordance with the provisions of Section 01 63 00.

E. Refer to Part 3 - Execution, for additional review documentation procedures.

2.3 SAMPLES

A. When required by Part 1 - General of the respective Sections of the Specifications, submit physical examples of each item which

illustrate materials, equipment, or workmanship, and establish standards by which the work will be judged.

B. All products requiring color selection shall be submitted prior to any selection of colors by the Architect/Engineer. Allow sufficient time for color selection of all items so as not to delay construction progress.

2.4 QUALITY CONTROL SUBMITTALS

A. Test Reports: When and as directed by the Architect/Engineer, submit certified laboratory test reports confirming physical characteristics of materials used in the performance of the work. Refer to Section 01 45 00 for general requirements for inspections and tests.

B. Manufacturer's Instructions: Submit manufacturer's current recommended methods of installation, including relevant limitations, safety and environmental cautions, and application rates.

2.5 EQUIPMENT ROOM LAYOUT DRAWINGS

A. Prepare and submit equipment room layout drawings where required by the Contract Drawings and additionally for areas where equipment proposed for use could present interface or space difficulties.

1. Submit room layout drawings within 10 calendar days after receipt of Notice to Proceed in conformance with the requirements specified for Shop Drawings.

2. Include elevations of wall mounted items.

2.6 CERTIFICATES OF COMPLIANCE

A. When required by Part 1 - General of the respective Sections of the Specifications, furnish certificates to demonstrate compliance of materials with specification requirements, including statements of application and extended guaranties, executed in duplicate. Furnish certificates to the Architect at least 10 days prior to delivery of product. Review certificates before submittals are made to ensure compliance with the specification requirements, and to ensure that the affidavit is properly executed.

1. Furnish certificates relative to flame-resistance for all decorative materials.

B. Furnish certificates signed by an official authorized to act on behalf of the manufacturing company, material supplier, or other third-party entity, as required. Furnish certificates that contain the name and address of the Contractor, the Project name and location, and the quantity and dates of shipment or delivery to which the certificates apply. In the case of copies of laboratory test reports submitted with certificates, furnish test reports which contain the name and address of the testing laboratory and the dates of the tests to which the report applies.

C. Certification will not be construed as relieving the Contractor from furnishing satisfactory material if, after tests are performed on selected samples, the material is found not to meet the specific requirements.

2.7 CONSTRUCTION COST BREAKDOWN

A. Within 10 calendar days after issuance of Notice to Proceed, submit a Construction Cost Breakdown (Schedule of Values) based on final Contract Sum and scope of work for use in evaluating construction progress and certificates of payment.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Check subcontractor-submitted drawings and data, verify field measurements, apply review stamp, and submit to the Architect/Engineer promptly.

1. Indicate on review stamp that Contractor has reviewed subcontractor's submittal for conformance to the specified product and submittal procedures.

2. Disapprove and return to the material supplier, submittals not meeting the requirements of the Contract Documents.

3.2 ARCHITECT'S REVIEW

A. The Architect/Engineer will review, and either accept or reject with reasonable promptness and as outlined in the accepted submittal schedule, data and drawings submitted by the Contractor. The Architect/Engineer will review submittals for conformance with the intent of the design, and for compliance with specific and relevant requirements of the Contract Documents.

1. The Architect/Engineer will reject and return to the Contractor, Shop Drawings and product literature submitted without the Contractor's review stamp.

2. The Architect/Engineer will reject and return to the Contractor, Shop Drawings not thoroughly reviewed by Contractor prior to submittal.

B. The Architect/Engineer is not responsible for delays caused by rejection of Shop Drawings submitted by the Contractor.

C. Review Procedures:

1. Review will not relieve the Contractor from responsibility for errors.

a. Acceptance of submittals shall not be construed as authorizing changes in the Contract Sum or Contract Time, nor shall it be construed as relieving the Contractor of his responsibility for coordination of work with other trades, or interpreted as approving quantities and dimensions.

2. Notations:

a. REVIEWED: Fabrication, manufacture, or construction may proceed.

b. MAKE CORRECTIONS NOTED: Fabrication, manufacture, or construction may proceed providing submittal complies with comments and notations. If, for any reason, Contractor cannot comply with the comments and notations, Contractor shall bring reasons to the attention of the Architect/Engineer promptly. If Contractor cannot comply with the comments and notations, the MAKE CORRECTIONS NOTED becomes REJECTED. The Contractor shall return the revised version of the submittal to the Architect/Engineer when requested to do so.

c. REJECTED: Submittal does not comply with the Contract Documents and fabrication, manufacture, and construction shall not proceed. Submittals stamped REJECTED are not permitted on the job site. Review and re-submit submittal.

3.3 DISTRIBUTION OF SUBMITTALS BY CONTRACTOR

A. After Architect's/Engineer's review, distribute copies of Shop Drawings and product data which carry the Architect's/Engineer's stamp as determined at the pre-construction meeting. If not otherwise determined, distribute one copy to each of the following:

1. Contractor's Project site file.

2. Project record documents file.

3. Subcontractor, supplier, or fabricator.

4. Other prime Contractors, if applicable.

5. Owner's Representative (at Owner's option).

B. Distribute samples as directed.

C. Maintain an up-to-date submittal log.

3.4 CONTRACTOR'S RESPONSIBILITY

A. The Architect's/Engineer's review of submittals or data shall not relieve the Contractor from responsibility for deviations from Contract Drawings or Specifications unless the Contractor has called the Architect's/Engineer's and Owner's attention to such deviations and secured written acceptance, nor shall it relieve him of responsibility for errors in Shop Drawings or other data.

B. In the event the Architect/Engineer rejects a submittal twice for valid reasons, including improper procedures, the Contractor shall accept the responsibility to pay for professional services to cover further processing of the submittal. A flat hourly rate, as agreed upon, shall be paid by the Contractor.

END OF SECTION

This page intentionally left blank.

COMPTON COMMUNITY COLLEGE DISTRICT

ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for Alteration or Modernization Projects for acceptance of existing site conditions, selective demolition, cutting and patching of existing buildings and site improvements, removal and reinstallation of existing materials, wiring and equipment and interface with existing construction.

B. Refer to other Sections for specific requirements and limitations applicable to Alteration or Modernization projects

C. Requirements of this Section apply to Sections in Divisions 2 through 16.

1.2 RELATED SECTIONS

A. Section 01 01 00 - Summary of work.

B. Section 01 73 20 - Cutting and Patching

1.3 ALTERATION PROJECTS GENERAL PROCEDURES

A. Alteration/Modernization projects require that the contractor may need to demolish, cut, alter, expose, modify, repair, replace, reconstruct, patch, reroute, or other construction procedures to interface new construction into existing construction.

B. The Drawings and specifications are not intended to show in detail all Alteration Project Procedures for interface of new construction into existing construction. It is the responsibility of the Contractor to include in the Contract Price Allowances for such Alteration Procedures.

1.4 QUALITY ASSURANCE

A. Matching existing Construction: On Alteration\Modernization projects new materials are to match existing materials for patching and extending work.

B. Determine type and quality of existing materials by inspection and testing. Existing construction shall be used as a standard of quality for new construction unless noted or specified otherwise.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that selective demolition is complete and areas are ready for installation of new work.

3.2 PREPARATION

A. Cut, move, or remove items as necessary for access to alteration and renovation work. Replace and restore prior to completion.

B. Remove unsuitable material not marked for salvage, such as rotted wood, corroded metals, and deteriorated construction. Replace materials as specified for the affected finish material.

C. Remove debris and abandoned items from area and from concealed spaces.

D. Remove surface finishes to provide for proper installation of new work.

E. Temporarily close openings in exterior surfaces to protect existing improvement from weather, temperature and humidity during construction of new work.

3.3 INSTALLATION

A. Coordinate work of Alteration/Modernization to expedite completion and to accommodate School occupancy of the facility.

B. Remove, cut and patch in a manner to minimize damage to existing facilities and to provide a means of restoring materials and finishes to original conditions.

C. Refinish visible existing surfaces to remain in Alteration/Modernization areas to specified condition for each material, with a neat transition to adjacent finishes.

D. In addition to the specified new equipment, fixtures, wiring, conduit, materials, etc. bring existing systems to full operational conditions before Alteration/Modernization work is completed.

E. Patch, repair and refinish work that was damaged during mechanical, electrical and other modernization work.

3.4 TRANSITIONS

A. Where the removal or addition of walls, ceilings and finishes abuts existing construction, construct a smooth and even transition. Patch new work to existing to match adjacent work in texture and appearance.

B. When existing surfaces are cut so that a smooth transition with new construction is not possible, terminate existing surface along a straight line at a natural line of division, such as a corner change in finish or a joint. Replace existing finish as required for a smooth transition.

C. Trim bottom of existing doors as required to clear new floor finish.

3.5 CONSTRUCTION INTERFERENCE

A. Where existing construction interferes with new construction, such as pipes, conduit, junction boxes, and other existing construction that may be in a location that is not compatible with new construction, contractor is to relocate, move, provide replacement or otherwise remove the construction interference.

B. Contractor is to field verify existing conditions and is not to reply on Existing Record Drawings provided by the School District. Contractor is not to rely on any verbal instructions or verbal locations given by School District Personnel unless given or stated in writing. Existing

Record drawings if provided are for information only and may not indicate the exact existing construction.

3.6 REPAIR OF DAMAGED SURFACES

A. Where removal of partitions, ceilings, walls or finishes results in adjacent spaces becoming damaged, rework floors, walls and ceilings to provide for a smooth plane without break, steps, or bulkheads.

B. Patch or replace portions of existing surfaces which are damaged, lifted, discolored, or showing other imperfections. Repair substrate prior to patching finish.

3.7 FINISHES

A. Finish surfaces as specified in individual Product sections.

B. Finish patches to produce uniform finish and texture over the entire area. When finish cannot be matched, refinish entire surface to nearest joint corner or intersection.

END OF SECTION

COMPTON COMMUNITY COLLEGE DISTRICT

REFERENCES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements for reference materials applicable to contract documents

B. Definitions of abbreviations, terms, and symbols.

C. Establishes edition dates for reference standards found elsewhere in the specifications.

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the General Conditions.

B. Indicated: The term "indicated" refers to graphic representations, notes, or schedules on the Drawings, other paragraphs or schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help the reader locate the reference; no limitation on location is intended. Except as specifically noted.

C. Directed: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean "directed by the Architect/Engineer," "requested by the Architect/Engineer," and similar phrases. However, no such implied meaning will be interpreted to extend Architect/Engineer responsibility into Contractor's area of construction supervision.

D. Approve: The term "approved," where used in conjunction with the Architect's/Engineer's action on the Contractor's submittals, applications, and requests, is limited to the Architect's/Engineer's duties and responsibilities as stated in General and Supplementary Conditions. In no case will "approval" by the Architect/Engineer be interpreted as a release of the contractor from responsibilities to fulfill requirements of contract documents.

E. Regulation: The term "Regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

F. Furnish: The term "furnish" is used to mean "supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations."

G. Install: The term "install" is used to describe operations at project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations."

H. Provide: The term "provide" means "to furnish and install, complete and ready for the intended use."

I. Installer: An "Installer" is the Contractor or an entity engaged by the Contractor, either as an employee, subcontractor, or sub-subcontractor, for performance of a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.

1. The term "experienced" when used with the term "Installer" means having a minimum of 5 previous Projects similar in size and scope to this Project, being familiar with the precautions required, and having complied with requirements of the authority having jurisdiction.

J. Project Site is the space available to the Contractor for performance of construction activities, either exclusively or in conjunction with others performing other work as part of the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land upon which the Project is to be built.

K. Testing Laboratories: A "testing laboratory" is an independent entity engaged to perform specific inspections or tests, either at the Project Site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.3 REFERENCE STANDARDS

A. Applicability of Standards: Except where the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Where the date of issue of a referenced standard is not specified, comply with the standard in effect as of bid date or date of Contract Execution, for projects that are not competitively bid.

C. Upon request, the Contractor is required to make available at the job site within a reasonable time a copy of all referenced standards referred to in the Specifications. Standards are to be maintained in the Project Job Site Office Library for use by the Architect/Engineer, School District and School District's inspector for the purpose of establishing requirements applicable to equipment, materials, quality and workmanship.

D. Conflicting Requirements: Where compliance with two or more standards is specified, and the standards establish different or conflicting requirements for minimum quantities or quality levels, refer requirements that are different, but apparently equal, and uncertainties to the Architect for a decision before proceeding.

1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. In complying with these requirements, indicated numeric values are minimum or maximum, as appropriate for the context of the requirements. Refer uncertainties to the Architect for a decision before proceeding.

1.4 ABBREVIATIONS

A. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where such acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards generating organization, authority having jurisdiction, or other entity applicable to the context of the text provision.

B. Refer to the "Encyclopedia of Associations," published by Gale Research Co., available in most libraries or the Construction Specifications Institute (CSI) Technical Document TD-2-5 November 1989, entitled "Sources of Construction Information".

PART 2 – PRODUCTS - (Not Applicable)

PART 3 – EXECUTION - (Not Applicable)

END OF SECTION

COMPTON COMMUNITY COLLEGE DISTRICT
1111 E. Artesia Blvd
Compton, California 90221
(310) 900-1600

RFQ CCC-055
Instructional Building 2

Work Plan and Milestone Schedule

Task Name	Finish Date
Pre-bid Mandatory Job Walk:	**9-5-19 @2PM**
Bid Opening:	**10-3-19 @2PM**
Notice of Intent to Award:	**10-4-19**
Start Construction Phase:	**11-18-19**
Construction Completion:	**9-1-21**
Punchlist/Closeout completion:	**10-26-21**

COMPTON COMMUNITY COLLEGE DISTRICT
INSTRUCTIONAL BUILDING #2
CONSTRUCTION SCHEDULE

ID	Task Name	Duration	Start	Finish
1	CCCD Board Approval	1 day	Tue 10/15/19	Tue 10/15/19
2	State/DOF Approval	1 day	Fri 11/15/19	Fri 11/15/19
3	Execute Contract	10 days	Mon 11/18/19	Fri 11/29/19
4	Execute Sub-Contracts	25 days	Mon 12/2/19	Fri 1/3/20
5	Mobilization	2 days	Mon 12/2/19	Tue 12/3/19
6	Submittals	45 days	Mon 12/2/19	Fri 1/31/20
7	Shop Drawings Sch.	45 days	Mon 12/2/19	Fri 1/31/20
8	Procurement Sch.	25 days	Mon 12/2/19	Fri 1/3/20
9	Manufacturing Sch.	45 days	Mon 12/2/19	Fri 1/31/20
10	Delivery Sch.	45 days	Mon 12/2/19	Fri 1/31/20
11	Detailed Constr. Sch.	15 days	Mon 12/2/19	Fri 12/20/19
12	Commissioning Sch.	35 days	Mon 12/2/19	Fri 1/17/20
13	**Christmas Break 2019**	**15 days**	**Wed 12/4/19**	**Tue 12/24/19**
14	Demolition	15 days	Wed 12/4/19	Tue 12/24/19
15	Re-Route Utilities	15 days	Wed 12/4/19	Tue 12/24/19
16	Demo of Pylons	10 days	Wed 12/25/19	Tue 1/7/20
17	Grading	20 days	Wed 12/25/19	Tue 1/21/20
18	Certified Pad-Bottom for Mat Slab	5 days	Wed 1/22/20	Tue 1/28/20
19	Mat Slab & Structural Inbeds	15 days	Wed 1/29/20	Tue 2/18/20
20	Concrete Walls	15 days	Wed 2/19/20	Tue 3/10/20
21	Backfill for New Finish Slab	15 days	Wed 3/11/20	Tue 3/31/20
22	Certified Pad - Foundation	5 days	Wed 4/1/20	Tue 4/7/20
23	U.G. Utilities/Foundation	10 days	Wed 4/8/20	Tue 4/21/20
24	Steel Erection/Stairs	60 days	Wed 4/22/20	Tue 7/14/20
25	First Floor	20 days	Wed 4/22/20	Tue 5/19/20
26	Second Floor	20 days	Wed 5/20/20	Tue 6/16/20
27	Roof Decking and Screens	20 days	Wed 6/17/20	Tue 7/14/20
28	HVAC/Sky Lights Curbs	20 days	Wed 7/8/20	Tue 8/4/20
29	Elevator	45 days	Wed 6/24/20	Tue 8/25/20
30	Roof Dry In and Completion	15 days	Wed 7/15/20	Tue 8/4/20
31	Set all Equipment	20 days	Wed 8/5/20	Tue 9/1/20
32	**Interior**	**310 days**	**Wed 6/24/20**	**Tue 8/31/21**
33	Interior Framing	50 days	Wed 6/24/20	Tue 9/1/20
34	Rough Elec./Plumbing	40 days	Wed 7/15/20	Tue 9/8/20
35	Rough HVAC	40 days	Wed 7/15/20	Tue 9/8/20
36	Rough Plumbing	40 days	Wed 7/15/20	Tue 9/8/20
37	Low Voltage	40 days	Wed 8/5/20	Tue 9/29/20
38	Testing & Insp.	10 days	Wed 9/30/20	Tue 10/13/20
39	Insulation	10 days	Wed 9/30/20	Tue 10/13/20
40	Door and Window Frames	20 days	Wed 9/2/20	Tue 9/29/20
41	Drywall	40 days	Wed 10/14/20	Tue 12/8/20
42	Measure for Metal Finishes	3 days	Wed 12/9/20	Fri 12/11/20
43	Wall Finishes	30 days	Wed 12/9/20	Tue 1/19/21
44	Bathroom Finishes	40 days	Wed 12/9/20	Tue 2/2/21
45	Flooring	25 days	Wed 2/3/21	Tue 3/9/21
46	Finish Elec. & Plumbing	20 days	Wed 3/10/21	Tue 4/6/21
47	Finish Glazing & Hardware	25 days	Wed 4/7/21	Tue 5/11/21
48	Install Interior Metal Finishes	50 days	Wed 1/27/21	Tue 4/6/21
49	Interior Stair Rails and Finishes	40 days	Wed 4/7/21	Tue 6/1/21
50	Elevator Finishes and Certs.	30 days	Wed 6/2/21	Tue 7/13/21
51	Testing and Commissioning	15 days	Wed 7/14/21	Tue 8/3/21
52	District Vendors/FFE	20 days	Wed 8/4/21	Tue 8/31/21
53	**Exterior**	**245 days**	**Wed 7/29/20**	**Tue 7/6/21**
54	Backing for Metal Cladding	20 days	Wed 7/29/20	Tue 8/25/20
55	Exterior Drywall	25 days	Wed 8/26/20	Tue 9/29/20
56	Measure for Metal Finishes	5 days	Wed 9/30/20	Tue 10/6/20
57	Stucco	25 days	Wed 10/7/20	Tue 11/10/20
58	Install Exterior Finishes	60 days	Wed 11/11/20	Tue 2/2/21
59	Remove Scaffold	5 days	Wed 2/3/21	Tue 2/9/21
60	Underground Elec. Service	20 days	Wed 2/10/21	Tue 3/9/21
61	Site Work	20 days	Wed 3/10/21	Tue 4/6/21
62	Exterior Stair Finishes	25 days	Wed 4/7/21	Tue 5/11/21
63	Finish Grading	15 days	Wed 5/12/21	Tue 6/1/21
64	Irrigation and Landscaping	25 days	Wed 6/2/21	Tue 7/6/21
65	Close Out and Punch List	15 days	Wed 8/4/21	Tue 8/24/21
66	**Demo E, F, & D Wings**	**75 days**	**Wed 7/14/21**	**Tue 10/26/21**
67	Abatement	15 days	Wed 7/14/21	Tue 8/3/21
68	Demolition	15 days	Wed 8/4/21	Tue 8/24/21
69	Grading	10 days	Wed 8/25/21	Tue 9/7/21
70	Utilities	15 days	Wed 8/25/21	Tue 9/14/21
71	Hardscape	15 days	Wed 9/15/21	Tue 10/5/21
72	Landscaping Irrigation	15 days	Wed 9/15/21	Tue 10/5/21
73	Landscaping	15 days	Wed 10/6/21	Tue 10/26/21
74	DG	15 days	Wed 10/6/21	Tue 10/26/21

COMPTON COMMUNITY COLLEGE DISTRICT

QUALITY CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Section specifies administrative and procedural requirements for quality control services.

B. Quality control services include inspections and tests and related actions including reports, performed by independent agencies, governing authorities, and the Contractor. They do not include Contract enforcement activities performed by the Architect/Engineer.

C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with Contract Document requirements.

D. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.

1. Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities. Those requirements, including inspections and tests, cover production of standard products as well as customized fabrication and installation procedures.

2. Inspections, test and related actions specified are not intended to limit the Contractor's quality control procedures that facilitate compliance with Contract Document requirements.

3. Requirements for the Contractor to provide quality control services required by the Architect/Engineer, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.2 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Inspections and testing required by laws, ordinances, rules, regulations or orders of public authorities: General Conditions.

B. Certification of Products: Respective specification sections.

C. Test, Adjust and Balance of Equipment: Respective specification sections.

1.3 RESPONSIBILITIES

A. The Owner will engage and pay for the services of an independent agency to perform inspections and tests specified as the Owner's responsibilities. Testing agency and project inspector shall have approval of the Division of the State Architect.

1.4 DEFICIENCIES

A. Tests or inspections due to the following will be reimbursed to the Owner by deductive change order.

1. Retesting because of failure of initial samples.

2. Additional costs due to overtime work or extra shifts work because of improper scheduling of work or of delivery of materials by Contractor.

3. Failure to properly notify laboratory.

4. Changes in sources, lots or suppliers of materials after original tests.

5. Changes in methods or materials of construction requested by Contractor that require testing, inspection, or other related services in excess of that required by original design.

6. Concrete mix designs in excess of first successful design for each concrete type.

7. Overtime or extra shift work requiring overtime work by Owner's Inspector.

8. This contractor will have the sole responsibility of coordinating the Schedule with the Construction Manager for Owner/General Contractor, Bid Package 01, provided Fire Watch.

1.5 TESTS

A. Selection of the material required to be tested shall be the responsibility of the laboratory or the Owner's representative and not selected by the Contractor.

B. The Contractor shall notify the Owner's representative a sufficient time in advance of the manufacture of material to be supplied by him under the Contract Documents, which must be tested, in order that the Owner may arrange for the testing of material at the source of supply.

C. Any material shipped by the Contractor from the source of supply prior to satisfactory testing and inspection or prior to the receipt of notice from said representative that testing and inspection will not be required shall not be incorporated in the work.

D. Duties of the Testing Agency: The independent testing agency engaged to perform inspections, sampling and testing of materials and construction specified in individual Specification Sections shall cooperate with the Architect/Engineer and Contractor in performance of its duties, and is to provide qualified personnel to perform required inspections and tests.

1. Notify the Architect/Engineer and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

2. The agency is not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.

3. The agency shall not perform any duties of the Contractor.

E. Perform specified instructions, sampling and testing of materials and methods of construction:

1. Comply with specified standards; ASTM, other recognized authorities, and as specified.

2. Ascertain compliance with requirements of Contract Documents.

3. Comply with requirements of Title 24, Part I, Sec. 4-333.

F. Coordination: The Contractor and each agency engaged to perform inspections, tests, Fire Watch and similar services shall coordinate the sequence of activities to accommodate required services with a

minimum of delay. In addition the Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.

1.6 SUBMITTALS

A. Promptly submit copies of reports of inspections and tests mill analysis, concrete mix designs and certifications per applicable sections of the specifications.

1. Comply with requirements of Division of State Architect testing and inspection requirements.

2. One copy of all test reports shall be forwarded to the Division of the State Architect by the testing agency. Such reports shall include all tests made, regardless of whether such tests indicated that the material is satisfactory or unsatisfactory. Samples taken but not tested shall also be reported. The reports shall show that the material or materials were sampled and tested in accordance with the requirements of Title 24, CCR and with the approved specifications. Test reports shall show the specified design strength. They shall also state definitely whether or not the material or materials tested comply with requirements.

3. Verification of Test Reports: Each testing agency shall submit to the Office of the State Architect a verified report in duplicate covering all of the tests which are required to be made by the agency during the progress of the project. Such report shall be furnished each time that work on the project is suspended, covering the tests up to that time, and at the completion of the project, covering all tests.

4. Submit one copy of all test reports to:

   a. Owner

   b. Architect/Engineer

   c. Structural Engineer

   d. Contractor

   e. Inspector

   f. Division of the State Architect (DSA)

g. Submit verification of test reports to DSA per Title 24, Part 1, CCR, Sec. 4-336.

1.7 QUALITY ASSURANCE

A. All tests and inspection required by the Division of the State Architect are to be conducted in strict accordance with requirements of Title 24, CCR.

B. Contractor shall comply with all Project Inspection Card requirements (DSA Form 152), DSA PR 13-01 and 13-02, and all related DSA required inspection and testing requirements.

1.8 INSPECTION BY THE SCHOOL DISTRICT

A. The School District and its representative shall at all times have access for the purpose of inspection to all parts of the work and to the shops wherein the work is in preparation, and the Contractor shall at all times maintain proper facilities and provide safe access for such inspection.

B. The School District shall have the right to reject materials and workmanship which are defective, or to require their correction. Rejected workmanship shall be satisfactorily corrected and rejected materials shall be removed from the premises without charge to the School District. If the Contractor does not correct such rejected work within a reasonable time, fixed by written notice, the School District may correct same and charge the expense to the Contractor.

C. Should it be considered necessary or advisable by the School District at any time before final acceptance of the entire work to make an examination of work already completed by removing or tearing out the same, the Contractor shall on request promptly furnish all necessary facilities, labor and materials. If such work is found to be defective in any respect due to fault of the Contractor or his subcontractor, he shall defray all expenses of such examinations and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the Contract, the additional cost of labor and materials necessarily involved in the examination and replacement shall be allowed the Contractor.

D. District to provide an Inspector employed by the District in accordance with the requirements of the California Code of Regulations, Title 24, to be assigned to the work. His duties are specifically defined in Title 24, Part I, Sec. 4-342. The work of

construction in all stages of progress shall be subject to the personal continuous observation of the Inspector. He shall have free access to any or all parts of the work at any time. The contractor shall furnish the Inspector reasonable facilities for obtaining such information as may be necessary to keep him fully informed respecting the progress and manner of the work and the character of the materials. Inspection of the work shall not relieve Contractor from any obligation to fulfill this Contract.

1.9 WORK BY DISTRICT'S INSPECTORS

A. General inspection of construction.

B. Concrete slump tests.

C. Concrete cylinder samples.

D. Cement samples and tests.

E. Reinforcing Steel sample and test, (#5 and larger).

F. Continuous inspection of Structural Concrete placement.

G. Structural Steel sample and test.

H. Continuous inspection of welds, (shop and field).

1.10 CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with laboratory personnel, provide access to work, to manufacturer's operations.

B. Provide to laboratory, selected preliminary representative samples of materials to be tested, in required quantities.

C. Furnish casual labor and facilities:

1. To provide access to work to be tested.

2. To obtain and handle samples at the site.

3. To facilitate inspections and tests.

4. For laboratory's exclusive use for storage and curing of test samples.

D. Notify laboratory sufficiently in advance of operations to allow for his assignment of personnel and scheduling of tests. Per Specification Section 1305, the contractor will provide an updated 2 Week Look Ahead to ensure proper and timely scheduling.

PART 2 - PRODUCTS - (Not Applicable)

PART 3 - EXECUTION

3.1 MISCELLANEOUS TESTS AND INSPECTIONS

A. Soil and Compaction Testing and Inspection: Performed by soils engineer employed and paid by the School District.

B. Roofing Inspection: As specified in Section "Built-Up Roofing".

C. Moisture and Bond Tests for resilient flooring and non-breathing floor surface materials. Performed by Independent Testing Agency and paid for by the School District.

D. Special Tests: Special tests requested by School District, Architect or Division of the State Architect will be paid for by the School District, except that if such tests fail, the costs for failed tests and additional retesting shall be deducted from the Contract Price by Change Order.

3.2 SCHEDULE OF TESTS, INSPECTIONS AND METHODS

A. Foundations (Chapter 18A):

1. Earth Fill Compaction: 1802A

B. Concrete (Chapter 19A):

1. Materials:

a. Portland Cement Tests: 1929A.1

b. Concrete Aggregates: 1903A.3

c. Reinforcing Bars: 1903A.5, 1929A.2

d. Batch Plant Inspection and Tests: 1929A.4

2. Concrete Quality:

   a. Proportions of Concrete: 1905A.2.3, 1905A.3.1.1, 1905A.3.3.2, 1905A.4

   b. Strength Tests of Concrete: 1905A.6

   c. Splitting of Tensile Test 1905A.1.5

3. Concrete Inspection:

   a. Job Site Inspection: 1905A.7

   b. Batch Plant or Weighmaster Inspection: 1929A.4

C. Structural Steel (Chapter 22A):

1. Materials:

   a. Structural Steel, Cold-Formed Steel: 2203A.3

   b. Structural Steel Construction: 2203A.2

2. Inspection and tests of Structural Steel:

   a. Tests of Structural and Cold Formed Steel: 2231A.1

   b. Tests of End-Welded studs (Nelson Studs): 2231A.3

   c. Welding Inspection: 2231A.5

   d. High Strength Bolts: 2231A.2

D. Wood (Chapter 23A):

1. Materials:

   a. Lumber and Plywood Grading: 2303A.1. 2303A.2

   b. Glue-Laminated Member testing: 2337A.1

   Note: Chapters and Articles refer to 1997 UBC and 1998 Title 24 Part 2, California Building Code (CBC), 1998

3.3 REPAIR AND PROTECTION

A. General: upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes. Comply with Contract Document requirements for "Cutting and Patching".

B. Protect construction exposed by or for quality control service activities, and protect repaired construction.

C. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar service.

END OF SECTION

This page intentionally left blank.

COMPTON COMMUNITY COLLEGE DISTRICT

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies requirements for temporary services and facilities, including utilities, construction and support facilities, security and protection.

B. Temporary utilities required include but are not limited to:

1. Water service and distribution.

2. Temporary electric power and light.

3. Telephone service with separate Fax line.

4. Storm and sanitary sewer.

C. Temporary construction and support facilities required include but are not limited to:

1. Temporary heat.

2. Field offices and storage sheds.

3. Sanitary facilities, including drinking water.

4. Temporary enclosures.

5. Temporary Project identification sign.

6. Waste disposal services.

D. Security and protection facilities required include but are not limited to:

1. Temporary fire protection. Coordination of Fire Watch.

2. Barricades, warning signs.

3. Environmental protection.

4. Temporary security fencing when required and in compliance with the Phase temporary fencing provided by Bid Package xx.

1.2 SUBMITTALS

A. Temporary Utilities: Submit reports of tests, inspections, meter readings and similar procedures performed on temporary utilities.

1.3 RELATED WORK

A. All equipment furnished by subcontractors shall comply with all requirements of pertinent safety regulations. The ladders, planks, hoists, and similar items normally furnished by the individual trades in execution of their own portions of the work are not part of this section.

B. Permanent installation and hook-up of the various lines are described in the other pertinent sections.

1.4 QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, including but not limited to:

1. Building Code requirements.

2. Health and safety regulations.

3. Utility company regulations.

4. Police, Fire Department and Rescue Squad rules.

5. Environmental protection regulations.

B. Standards: Comply with NFPA Code 241, "Building Construction and Demolition Operations", ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition", and NECA Electrical Design Library "Temporary Electrical Facilities."

1. Refer to "Guidelines for Bid Conditions for Temporary Job Utilities and Services", prepared jointly by AGC and ASC, for industry recommendations.

2. Electrical Service: Comply with NEMA, NECA and UL standards and regulations for temporary electric service. Install service in compliance with National Electric Code (NFPA 70).

C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.5 PROJECT CONDITIONS

A. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide new materials; if acceptable to the Architect/Engineer, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.

B. Water: Provide potable water approved by local health authorities.

2.2 FIELD OFFICE

A. Provided by this Bid Package; Provide on-site, adequate field space for use by construction forces, the District Inspector, and the Architect during the time construction is in progress. The offices shall be conveniently located and shall be watertight and waterproof, clean, insulated, heated, cooled, lockable, provided with windows to give adequate light and ventilation, have electrical service outlets, and have a floor. Minimum size of temporary site construction is 360 square feet.

1. The Contractor shall provide and pay for separate telephone service for phone and fax machine. Telephone and fax machines are to be on separate telephone line.

2. Equip with a minimum of one desk and a layout table. Equip with additional folding chairs for field meetings.

3. The offices, equipment, and furniture shall remain the property of the Contractor and shall be removed by contractor upon completion of work.

4. A complete set of approved plans and specifications shall be kept in the office at all times.

B. Inspectors Field Office: Contractor is required to provide for the use of the School District's Inspector a temporary office space to be located as directed by the Inspector and to be maintained until removal is authorized by the School District. Space is to have a lockable separate room area with a table for plans and a desk with two chairs. At least one entrance to Inspector office space is to be from the outside and not through the Contractors field office space. Provide and pay for high speed internet service. Maintain for Inspector until completion of the Contract.

2.3 TOILET FACILITIES

A. Provided by Each Bid Package for their personnel; Provide, install and maintain, for during of the work, temporary outside toilet facilities for use of construction personnel. Toilet facilities shall be constructed, maintained and supplied as required for the numbers of construction personnel required, and according to local regulations.

2.4 FIRST AID

A. Maintain such first aid supplies as may be required for minor accidents. Make arrangements with local emergency center and nearest hospital to receive cases requiring medical attention, including emergencies. Such information shall be conspicuously displayed at the construction office.

2.5 WATCHMAN SERVICES

A. Provided by this Bid Package; The Contractor shall provide such watchman services as he may deem necessary to properly safeguard materials, tools, appliances, and work during all hours that operations under the Contract are not actively proceeding. The District will not assume any responsibility for the loss of or damage to materials, tools, appliances or work arising from acts of theft, vandalism, malicious mischief, or other causes.

2.6 FIRE PROTECTION

A. Provide fire extinguisher on the premises during the course of construction of the type and sizes recommended by the NBFU to control fires resulting from the particular work being performed. Instruct employees in their use. Place extinguisher in the immediate vicinity of the work being performed, ready to be used.

B. During the use of hazardous equipment such as acetylene torches, welding equipment, bitumen kettles, salamanders and similar devices, no work shall be commenced or equipment used unless fire extinguisher of an approved type and capacity are placed in the working area and available for use by the workmen using such hazardous equipment.

C. Provide fire extinguisher conforming to the requirements, as minimums, of NFPA 10 and 241.

2.7 SAFETY AND PROTECTION

A. Provided by this Bid Package the Contractor shall furnish and erect temporary or permanent fences around the areas, as indicated on the drawings, and elsewhere where required for protection of the work, and to prevent unauthorized persons from entering the construction area. Temporary fences shall be at least eight feet (6'-0") above grade, of chain link or other substantial construction. Necessary gates for access to the site shall be placed where directed by the School District.

B. Furnish or construct barricades, lights and other guards about the work area that may be required by local ordinance or for public safety and necessity. Protect all work from vandalism.

2.8 TEMPORARY UTILITY SERVICES

A. Provided by this Bid Package; Power and Lighting: Furnish, install and maintain temporary wiring, poles, meter board, service entrance switch, lamps and equipment necessary to provide temporary lighting and power for the construction site.

1. Temporary power is available from location as directed by the Power Company.

2. Any temporary transmission lines required shall be installed by Contractor.

3. Provide power sources within eighty feet of any working position to allow the use of one hundred foot extension cords.

B. Water: Install required temporary connections to existing water. Locate temporary pipelines so that they do not interfere with traffic or drainage. Design and construct such pipelines so that they do not leak or cause damage or nuisance.

1. Upon completion of work, remove all temporary piping.

2.9 HEAT AND VENTILATION

A. Provide temporary heat and ventilation as required to maintain adequate environmental conditions to facilitate the progress of the work, to meet specified minimum conditions for the installation of materials, and to protect materials and finishes from damage due to temperature and humidity.

1. Pay costs of installation, maintenance, operation and removal, and fuel consumed.

2.10 CONSTRUCTION AIDS

A. Provide construction aids and equipment required by personnel and to facilitate the execution of the work; scaffolds, staging, ladders, stairs, ramps, runways, platforms, railings, hoists, cranes, chutes and other such facilities and equipment.

B. Provide all necessary facilities and means of access to all parts of the structure so that Governmental Agency Inspectors, Special Inspectors and the Architect and Structural Engineer may inspect any portion of the structure.

1. Means of access includes, but is not limited to, ladders, and/or scaffolds.

2.11 ACCESS ROADS AND PARKING AREAS

A. Prior to starting work, the Contractor, District and the Architect or his representative shall make a thorough survey of the site and approaches thereto. The Contractor will maintain temporary access roads required to perform the work and locate construction offices at locations approved by the Architect/Engineer and the District. The Contractor shall verify all grade elevations indicated on the Drawings at the site and immediately notify the Architect/Engineer if any

deviations are found. The Contractor shall assume all responsibility if any work proceeds without such notification.

B. Maintain specific vehicular access as required for the orderly progress of the work. Fill, compact and grade areas as necessary to provide suitable support during all weather conditions for anticipated loads including municipal fire apparatus. Provide adequate surface drainage and do not interrupt natural flow of existing drainage.

C. Provide designated parking areas for use by construction personnel.

D. Restore temporary vehicular access and parking areas to original or to specified conditions at completion of work.

2.12 TEMPORARY CONTROLS

A. Provide and maintain methods, equipment, and temporary construction, as necessary to provide controls over environmental conditions at the construction site and related areas under Contractor's control; remove physical evidence of temporary facilities at completion of work.

B. Dust Control: Provide positive methods and apply dust control materials and methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into the atmosphere.

C. Water Control: Provide methods to control surface water to prevent damage to the Project, the site, or adjoining properties.

1. Control fill, grading and ditching to direct surface drainage away from excavations, pits, tunnels, and other construction areas; and to direct drainage to proper runoff.

2. Provide, operate and maintain hydraulic equipment of adequate capacity to control surface water.

3. Dispose of drainage water in a manner to prevent flooding, erosion, or other damage to any portion of the site or to adjoining areas.

D. Pollution Control:

1. Provide methods, means and facilities required to prevent contamination of soil, water or atmosphere by the discharge of noxious substances from construction operations.

2. Provide equipment and personnel; perform emergency measures required to contain any spillages, and to remove contaminated soils or liquids.

E. Excavate and dispose of any contaminated earth off-site, and replace with suitable compacted fill and topsoil.

1. Take special measures to prevent harmful substances from entering public waters and atmosphere.

a. Prevent disposal of wastes, effluent, chemicals, or other such substances in sanitary or storm sewers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed, or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where the company provides only part of the service, provide the remainder with matching, compatible materials and equipment; comply with the company's recommendations.

1. Arrange with the company and existing users for a time when service can be interrupted, where necessary, to make connections for temporary services.

2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.

3. Obtain easements to bring temporary utilities to the site, where the Owner's easements cannot be used for that purpose.

4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Architect, and will not be accepted as a basis of claims for a Change Order.

B. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use. Water may be taken from existing site water supply.

1. Sterilization: Sterilize temporary water piping prior to use.

C. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload protected disconnects, automatic ground-fault interrupters and main distribution switch gear.

3.3 PROJECT IDENTIFICATION AND SIGNS

A. Project Identification and Temporary Signs: Prepare project identification and other signs of the size indicated; install signs where indicated to inform the public and persons seeking entrance to the Project. Support on posts or framing of preservative treated wood or steel. Do not permit installation of unauthorized signs.

B. Provide temporary on-site informational signs.

1. As required by codes, laws and regulatory agencies.

2. To identify key elements of the construction facilities.

3. To direct traffic.

C. Project Identification Sign: Size, design and information lettered as specified and as shown on drawing located at the end of this section. Finish with 3 coats of paint. Locate sign as indicated or directed by the Architect and School District.

3.4 OWNERSHIP OF TEMPORARY FACILITIES AND CONTROLS

A. Items provided by the Contractor under this section shall remain the property of the Contractor and shall be removed from the job site immediately upon completion of the work.

3.5 COLLECTION AND DISPOSAL OF WASTE

A. Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg F (27 deg C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material in a lawful manner.

3.6 OPERATION, TERMINATION AND REMOVAL

A. Termination and Removal: Unless the Architect requests that it be maintained longer, remove each temporary facility when the need has ended, or when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of the Contractor. The School District reserves the right to take possession of Project identification signs.

END OF SECTION

COMPTON COMMUNITY COLLEGE DISTRICT

PRODUCT OPTIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Section establishes procedures for specified product options.

B. The intent of this section is to insure that specified product options exceed or equal the quality of the specified products and are furnished and installed in accordance with the design intent.

C. This Section does not apply to any substitution requests that should have been made at time of bid in accordance with the Instructions to Bidders and the bid documents. The District can reject any requests for substitution in its sole discretion if the Contractor did not submitted a request at the time of bid in accordance with the Instructions to Bidders and the bid documents.

1.2 RELATED SECTIONS

A. Information for Bidders

B. Instructions to Bidders

C. General and Supplementary Conditions

D. Section 01 25 00- Contract Modification Procedures

E. Section 01 33 00 - Submittal Procedures

F. Section 01 63 00 - Product Substitution Procedures

1.3 PRODUCT OPTIONS

A. Where product options are included in the specifications sections and are specified by naming more than one, or several acceptable products or manufacturers, select any product or manufacturer listed.

1. Where more than one manufacturer or product is listed in the specifications and only one manufacturer or product is specified in detail with model numbers and features, the one specified in detail shall be considered the standard of quality required for all manufacturers or products listed.

B. Where product options are included in the specifications and they are followed by an "or equal " or "approved equal" or equal meeting a specified standard, review and approval by the Architect/Engineer and School District is required for Contractor-proposed equal items. Procedures specified in Section 01630 are to be followed.

C. For items specified only by Reference Standards, select any item meeting standards.

D. Performance Specifications: For items specified by performance requirements, select any item meeting the performance standards specified.

E. Descriptive Specifications: When specifications describe a product or assembly, listing exact components and characteristics, without the use of a brand or trade name, provide a product or assembly that contains the components and characteristics specified.

F. Compliance with Standards Specifications: When specifications only require compliance with a Code, Regulation or Voluntary Standard, Provide products that comply with the specified Codes, Regulations or Standards.

G. Submit request, as required for substitution, for any item or manufacturer not specifically named in the specifications on the Substitution Request Form enclosed with the Bidding Documents.

1. Architect/Engineer and School District will determine acceptability of proposed substitutions.

2. The Compton Community College District has a Resolution: No. 2009-10-21 and 2015-16-50 for the Designation of Specific Material, Product, or Service for numerous District Standard product and systems. (see attached resolutions for details).

PART 2 – PRODUCTS - (Not Applicable)

PART 3 – EXECUTION - (Not Applicable)

END OF SECTION

COMPTON COMMUNITY COLLEGE DISTRICT

PRODUCT SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Section establishes procedures for Contractor submittal of substitutions. This Section does not apply to any substitution requests that should have been made at time of bid in accordance with the Instructions to Bidders and the bid documents. The District can reject any requests for substitution in its sole discretion if the Contractor did not submitted a request at the time of bid in accordance with the Instructions to Bidders and the bid documents.

B. This Section provides procedures for review and compliance with Public Contract Code section 3400 for the "or equal" clause allowing bidders to furnish any equal material, product, thing or service. Or equal items proposed by bidders are considered substitutions and are subject to approval of the Architect and School District. Burden of proof for "Or Equals" is the responsibility of the Contractor.

C. The intent of this section is to insure that proposed substitutions exceed or equal the quality of the specified products and are furnished and installed in accordance with the Contract Documents.

1.2 RELATED SECTIONS

A. Information for Bidders

B. General and Supplementary Conditions

C. Section 01 62 00 - Product Options

D. Section 01 25 00- Contract Modification Procedures

1.3 SUBSTITUTIONS

A. Substitution requests are to be submitted by Generals Contractors Only. Requests submitted by Subcontractors, Material Suppliers, Manufacturers and other interested parties, other than General Contractors, will not be considered. Submit requests on the attached **SUBSTITUTION REQUEST FORM (AFTER BID)** in section 1305. **Substitution requests will only be considered for an "or equal" product specifically listed in the technical specifications for this project. No other substitutions will be considered.** (ie if Carrier

AC units are used on plans and specifications say “Carrier, Trane or York” – Trane or York would be considered as a substitution.)

B. Comply with provisions of Articles for Substitutions in the Information for Bidders, General Conditions and any modifications to these documents provided in the Supplementary Conditions.

C. Tabulate products by specification section number and title.

D. Submit separate request for each substitution. Support each request with the information and documents below and any other requirements in the General Conditions Article 3.10.:

1. Complete data substantiating compliance of proposed substitution with requirements stated in Contract Documents:

   a. Product identification, including manufacturer's name and address.

   b. Manufacturer's literature; identify:

      i. Product description.

      ii. Reference standards.

      iii. Performance and test data.

      iv. Fire resistance and fire ratings.

   c. Samples, as applicable.

   d. Name and address of similar projects on which product has been used, and date of each installation.

2. Itemized comparison of the proposed substitution with product specified; list significant variations.

3. Any effect the substitution may have on other trade contracts.

4. List of changes required in other work or products.

5. Accurate cost data comparing proposed substitution with product specified.

   a. Amount of any change in cost.

6. Designation of required license fees or royalties.

7. Designation of availability of maintenance services, sources of replacement materials.

8. Comparison of physical size and weight with product specified.

9. Comparison of physical shape and available finishes.

E. Substitutions will not be considered for acceptance when:

1. They are indicated or implied on shop drawings or product data submittals and where not approved in compliance with the General Conditions and this section.

2. Substitution request procedures included in this Section, the Information for Bidders, and in the General and Supplementary Conditions are not complied with by the Contractor.

3. The School District has determined that compatibility, standardization, technological sophistication, service and uniformity are necessary with regard to technological and certain safety items across the Schools in the District.

4. The request for substitution, as determined by the District, should have been submitted at the time of bid in accordance with the Instructions to Bidders and the bid documents.

F. Substitute products shall not be installed in the construction without written acceptance of the Architect and School District.

G. Architect and School District will determine acceptability of proposed substitutions prior to awarding of the Contract. Substitutions may be approved after award of the Contract only where the following conditions exist and only at the School District's sole discretion:

1. Specified item has been discontinued or is not unavailable to meet project schedule.

2. The School District requested the Substitution.

3. Substitution will reduce the Contract Amount and Contract Time (Credit Back to the District) without reducing quality.

1.4 CONTRACTOR'S SUBSTITUTION CERTIFICATION

A. In making formal request for substitution contractor certifies that:

1. He has investigated proposed product and has determined that it is equal to or superior in all respects to that specified.

2. He will provide same warranties or bonds for substitution as for product specified.

3. He will coordinate installation of accepted substitution into the work, and will make such changes as may be required for the work to be complete in all respects including modification of the work of other trades.

4. He waives claims for additional costs caused by substitution which may subsequently become apparent.

5. Substituted material is similar in physical appearance, size and weight and will install with the same opening and attachments.

6. Substituted material has the same or better fire rating and fire resistive qualities, including flame spread, smoke developed, UL tested and listing.

7. Meets all requirement set forth in the General Conditions Article 3.10.

1.5 ARCHITECT'S/ENGINEER'S DUTIES

A. Review contractor's request for substitutions with reasonable promptness.

B. Consult with District and provide notification to contractor, in writing, of decision to accept or reject requested substitution.

1.6 AVAILABILITY OF SPECIFIED ITEMS

A. Verify prior to bidding that all specified and substituted items will be available in time for installation during orderly and timely progress of the work.

B. In the event specified items will not be available, notify the Architect prior to receipt of bids.

C. Cost of delays because of non-availability of specified items, when such delays could have been avoided by the Contractor, will be back-charged as necessary and shall not be borne by the Architect or School District.

1.7 SUBSTITUTION WARRANTY REQUIREMENTS

A. Submit with the substitution request an executed Substitution Warranty. The Form is provided at the end of this Section. This form shall apply to substitutions submitted for acceptance prior to bid, prior to award of contract and for substitutions required after contract has been executed.

B. The Contractor is to warrant, in writing on company letterhead, that the substituted items are to perform as specified, and assume complete responsibility for the same. This includes responsibility and costs required for modifications to building, other materials, or equipment, and any additional coordination with work of other trades. The Contractor if required or requested by the Architect or School District shall pay for testing, of Substitution proposed.

PART 2 – PRODUCTS - (Not Applicable)

PART 3 – EXECUTION - (Not Applicable)

END OF SECTION

This page intentionally left blank.

COMPTON COMMUNITY COLLEGE DISTRICT

CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Cleaning throughout the construction period and final project cleaning prior to the acceptance tour.

B. Related Work Described Elsewhere: In addition to standards specified herein, comply with requirements for cleaning as described in other sections of these Specifications.

1.2 QUALITY ASSURANCE

A. Inspection: Conduct daily inspection, and more often if necessary, to verify that requirements of cleanliness are being met.

B. Codes and Standards: In addition to the requirements specified herein, comply with pertinent requirements of authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 CLEANING MATERIALS AND EQUIPMENT

A. Provide required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.

2.2 COMPATIBILITY

A. Use cleaning materials and equipment that are compatible with the surfaces being cleaned, as recommended by the manufacturer of the material to be cleaned.

PART 3 - EXECUTION

3.1 PROGRESS CLEANING

A. General:

1. Retain stored items in an orderly arrangement allowing maximum access, not impeding drainage or traffic, and providing the required protection of materials.

2. Do not allow the accumulation of scrap, debris, waste materials, and other items not required for construction of this work. Debris shall be removed from the site and disposed of in a lawful manner.

Disposal receipts of dump tickets shall be furnished to Architect/Engineer upon request.

3. At least twice each month, and more often if necessary, remove scrap, debris, and waste material from the job site.

4. Provide adequate storage for items awaiting removal from the job site, observing requirements for fire protection and protection of the ecology.

B. Site:

1. Daily, and more often if necessary, inspect the site and pick up all scrap, debris, and waste material. Remove items to the place designated for their storage. Combustible waste shall be removed from the site. Flammable waste shall be kept in sealed metal containers until removed from the site.

2. Weekly, and more often if necessary, inspect arrangements of materials stored on the site; restack, tidy, or otherwise service arrangements to meet the requirements specified above.

3. Maintain the site in a neat and orderly condition.

C. Structures:

1. Daily, and more often if necessary, inspect the structures and pick up scrap, debris, and waste material. Remove items to the place designated for their storage.

2. Daily, and more often if necessary, sweep interior spaces clean.

a. “Clean”, for the purpose of this subparagraph, shall be interpreted as meaning free from dust and other materials capable of being removed by use of reasonable effort and a handheld broom, i.e., “broom-clean”.

3. As required preparatory to installation of succeeding materials, clean the structures of pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using equipment and materials required to achieve the required cleanliness.

4. Following the installation of finish floor materials, clean the finish floor daily, and more often if necessary, and while work is being performed in the space in which finish materials have been installed.

a. “Clean”, for the purpose of this subparagraph, shall be interpreted as meaning free from foreign material that, in the

opinion of the Architect, may be injurious to the finish floor material, i.e., “vacuum- clean”.

3.2 FINAL CLEANING

A. Definition: Except as otherwise specifically provided, “clean”, for the purpose of the Article, shall be interpreted as meaning the level of cleanliness generally provided by skilled cleaners using commercial quality building maintenance equipment and materials, i.e., “scrub and polish clean”.

B. General: Prior to completion of the work, remove from the job site all tools, surplus materials, equipment, scrap, debris, and waste and conduct final progress cleaning as described above.

C. Site: Unless otherwise specifically directed by the Architect, water and broom clean paved areas on the site and public paved areas directly adjacent to the site. Remove resultant debris.

D. Structures:

1. Exterior: In areas affected by the work under this contract, visually inspect exterior surfaces and remove traces of soil, waste material, smudges, and other foreign matter. Remove traces of splashed material from adjacent surfaces. If necessary to achieve a uniform degree of exterior cleanliness, hose down the exterior of the structure.

   In the event of stubborn stains not removable with water, the Architect may require light sandblasting or other cleaning at no additional cost to the Owner.

2. Interior: In areas affected by the work under this contract, visually inspect interior surfaces and remove traces of soil, waste material, smudges, and other foreign matter. Remove traces of splashed materials from adjacent surfaces. Remove paint drippings, spots, stains, and dirt from finished surfaces. Use only the cleaning materials and equipment instructed by the manufacturer of the surface material.

3. Glass: Clean glass inside and outside.

4. Polished surfaces: On surfaces requiring the routine application or buffed polish, apply the polish recommended by the manufacturer of the material being polished. Glossy surfaces shall be cleaned and shined as intended by the manufacturer.

E. Timing: Schedule final cleaning as accepted by the Architect to enable the Owner to accept a completely clean project.

3.3 CLEANING DURING OWNER’S OCCUPANCY

A. Should the Owner occupy the work or any portion thereof prior to its completion by the Contractor and acceptance by the Owner, responsibilities for interim and final cleaning of the occupied spaces shall be determined by the Architect in accordance with the General Conditions of the Contract.

END OF SECTION

COMPTON COMMUNITY COLLEGE DISTRICT

FIELD ENGINEERING

PART 1 - GENERAL

1.1 SUMMARY

A. General: This Section specifies administrative and procedural requirements for field engineering services, including, but not necessarily limited to, the following:

1. Land survey Work.

2. Civil engineering services.

3. Structural engineering services.

1.2 RELATED SECTIONS

A. Section 01 33 00 - Submittals

B. Section 31 00 00 - Earthwork

1.3 SUBMITTALS

A. Certificates: Submit a certificate signed by the Land Surveyor or Professional Engineer certifying that the location and elevation of improvements comply with the Contract Documents. These Surveys and updated “As-Builts” will be submitted with every pay application for review and acceptance by the Engineer and Inspector of Record.

B. Submittal Copies of final as built property survey.

C. Project Record Documents: Submit a record of Work performed and record survey data as required under provisions of Sections "Submittals", "Project Closeout", and Specification Number 01 78 20 – “Project Record Documents”.

1.4 QUALITY ASSURANCE

A. Surveyor: Engage a Registered Land Surveyor registered in the State where the project is located, to perform land surveying services required.

B. Engineer: Engage a Professional Engineer of the discipline required, registered in the state of California, in which the Project is located, to perform required engineering services.

PART 2 – PRODUCTS - (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. The District will identify existing control points and property line corner stakes.

B. Verify layout information shown on the Drawings, in relation to the property survey and existing benchmarks before preceding to layout the Work. Locate and protect existing benchmarks and control points. Preserve permanent reference points (if any) during construction.

1. Do not change or relocate benchmarks or control points without prior written approval. Promptly report lost or destroyed reference points, or requirements to relocate reference points because of necessary changes in grades or locations.

2. Promptly replace lost or destroyed project control points. Base replacements on the original survey control points.

C. Establish and maintain a minimum of two permanent benchmarks on the site, referenced to data established by survey control points.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

D. Existing utilities and equipment: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of underground utilities and other construction. Contact underground service alert at 1(800) 422-4133 before start of construction.

1. Prior to construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer and water service piping.

3.2 PERFORMANCE

A. Working from lines and levels established by the survey, establish benchmarks and markers to set lines and levels at each story of construction and elsewhere as needed to properly locate each element of the Project. Calculate and measure required dimensions within indicated or recognized tolerances. Do not scale Drawings to determine dimensions.

1. Advise entities engaged in construction activities, of marked lines and levels provided for their use.

2. As construction proceeds, check every major element for line, level and plumb.

B. Surveyor's Log: Maintain a surveyor's log of control and other survey Work. Make this log available for reference.

1. Record deviations from required lines and levels, and advise the Architect when deviations that exceed indicated or recognized tolerances are detected. On Project Record Drawings, record deviations that are accepted and not corrected.

2. On completion of foundation walls, major site improvements, and other Work requiring field engineering services, prepare a certified survey showing dimensions, locations, angles and elevations of construction and site work.

C. Site Improvements: Locate and lay out site improvements, including pavements, stakes for grading, fill and topsoil placement, utility slopes and invert elevations by instrumentation and similar appropriate means.

D. Building Lines and Levels: Locate and lay out batter boards for structures, building foundations, column grids and locations, floor levels and control lines and levels required for mechanical and electrical Work.

E. Existing Utilities: Furnish information necessary to adjust, move or relocate existing structures, utility poles, lines, services or other appurtenances located in, or affected by construction. Coordinate with local authorities having jurisdiction.

F. Final Property Survey: Before Substantial Completion, prepare a final property survey showing significant features (real property) for the Project. Include on the survey a certification, signed by the Surveyor, to the effect that principal metes, bounds, lines and levels of the Project are accurately positioned as shown on the survey.

END OF SECTION

COMPTON COMMUNITY COLLEGE DISTRICT

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for cutting and patching, and interface of new work into existing construction and with work being performed under other contracts provided by the School District.

B. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the work.

1. Requirements of this Section apply to Sections in Divisions 2 through 16.

1.2 RELATED SECTIONS

A. Section 01 01 00 - Summary of work (Scope of Work).

B. Section 03 30 00 - Cast-in-place Concrete

C. Division 2 through 16 Sections

1.3 SUBMITTALS

A. Cutting and Patching Proposal: Approval of procedures for cutting and patching is required before proceeding, submit a proposal describing procedures well in advance of the time cutting and patching will be performed and request approval to proceed. Include the following information, as applicable, in the proposal:

1. Describe the extent of cutting and patching required and how it is to be performed.

2. Indicate dates when cutting and patching is to be performed.

3. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.

4. Refer to Structural Drawing for locations where cutting and patching involves addition of reinforcement to structural

elements. Do not damage or weaken existing structural elements.

5. Approval by the Architect/Engineer to proceed with cutting and patching does not waive the Architect's right to later require complete removal and replacement of a part of the work found to be unsatisfactory.

1.4 QUALITY ASSURANCE

A. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Architect's/Engineer's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace work cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 - EXECUTION

3.1 INSPECTION

A. Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather

conditions for portions of the Project that might be exposed during cutting and patching operations.

C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Take all precautions necessary to avoid cutting existing pipe, electrical wire and conduit or ductwork serving the building.

3.3 PERFORMANCE

A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

2. Where patching occurs in a smooth painted surface, extend final paint coat over entire surface containing the patch, after the patched area has received primer and second coat.

3. Cut, patch, point-up and repair plaster to accommodate other construction and to repair cracks, dents and imperfections.

4. Cut, patch, restore and repair all gypsum board wall and ceiling surfaces where new pipes, equipment, clocks, switches, conduit, ducts and any new construction items that would damage or cut existing surfaces.

5. Cut patch and repair existing concrete and asphalt paving where new utility lines are installed across existing paving and under existing concrete floor slabs. Site verify extent of cutting and patching required. All existing site improvements may not be indicated on the site plan and floor plans.

6. Cut existing walls, floors, ceilings and roofs or other parts of building structure to accommodate new ducts, conduits and piping, patch and repair existing.

7. Patch existing floors, walls, roofs and ceilings where existing ducts, conduit, equipment, water, gas, sewer, windows, doors etc. that are not used or removed and are not to be replaced. This is considered part of required general patching and is

part of the contract and will not be shown in detail on the Contract drawings. Field verify with existing site and building construction for patching required.

3.4 CLEANING

A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged areas to their original condition.

END OF SECTION

COMPTON COMMUNITY COLLEGE DISTRICT

WARRANTIES, GUARANTIES AND BONDS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This Section specifies general requirements for written warranties, guaranties and bonds required by the Contract Documents.

B. Submittal to, and approval by, the District of the warranties, guaranties and bonds are prerequisites to final payment under the Contract.

1.2 RELATED WORK

A. Related work specified elsewhere:

1. General Conditions –Section 00 72 00 Article 13

2. Contract Close-out - Section 01 77 00

1.3 TIME PERIOD

A. Deliver manufacturers' warranties, guaranties and bonds required by Contract Documents, with District named as beneficiary. For equipment and machinery, or components thereof, bearing a manufacturer's warranty or guaranty that extends for a longer time period than the Contractor's warranty and guaranty, deliver manufacturer's warranties or guaranties in same manner.

1.4 FORM

A. Written warranties and guaranties, excepting manufacturer's standard printed warranties and guaranties shall be submitted on the Contractor's, Subcontractors, material suppliers', or manufacturers' own letterhead, addressed to District. Warranties and guaranties shall be submitted in duplicate, and in the form shown on the following page, signed by all pertinent parties and by Contractor in every case, with modifications as approved by District to suit the conditions pertaining to the warranty or guaranty.

1.5 SUBMITTAL

A. The Contractor shall collect and assemble written warranties and guaranties from all subs, material suppliers and manufacturers into a bound booklet form, and deliver the bound books to Architect/Engineer for delivery to the District's attorney for final review and approval.

B. Submit required warranty/guaranty on letterhead of Contractor responsible for each type of Work in accordance with attached sample form.

C. The contractor will ensure that the Manufacturers will be scheduled in a timely manner to ensure that the start of the warranty period is well documented.

END OF SECTION

SECTION 017416 - STORM WATER POLLUTION PREVENTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Preparation, implementation and monitoring of Storm Water Pollution Prevention Plan (SWPPP) for the purpose of preventing the discharges of pollutants from the construction site into the receiving waters. This includes elimination of non-storm water pollution discharges such as improper dumping, spills or leakage from storage tanks or transfer areas.

B. Compliance with all local, state and federal regulations governing storm water discharges associated with construction activities such as, but not limited to clearing, excavating, grading, demolition and other land disturbances.

C. Payment of application and annual fees required by the State Water Resources Control Board (SWRCB) for the duration of the construction of the Project.

D. Submittal of all Permit Registration Documents (PRDs) through the SWRCB SMARTS online system.

E. Certification that the construction project has met all of the conditions of the General Construction Storm Water Permit (GCSWP).

1.02 REFERENCES

A. National Pollutant Discharge Elimination System (NPDES) General Permit No CAS000002.

B. State Water Resources Control Board (SWRCB) Water Quality Order 2009-0009-DWQ, as amended by 2010-0014-DWQ and 2012-006-DWQ.

C. California Stormwater Quality Association, Stormwater Best Management Practice Handbook, Construction, latest edition.

1.03 RELATED DOCUMENTS

A. Project Contract, including General, Special and Supplementary Conditions and other General Requirements.

1.04 ACRONYMS AND DEFINITIONS

BMP	Best Management Practice.
CAN	Corrective Action Notice.
CASQA	California Stormwater Quality Association.
COI	Change of Information.
DWQ	Division of Water Quality.
CGP	NPDES General Permit for Storm Water Discharges Associated with Construction Activities.
ELAP	Environmental Laboratory Accreditation Program.

LRP	Legally Responsible Person (OWNER).
NOI	Notice of Intent.
NOT	Notice of Termination.
NPDES	National Pollutant Discharge Elimination System.
OEHS	LAUSD Office of Environmental Health and Safety.
PRDs	Permit Registration Documents, including NOI, Risk Assessment, Site Map, SWPPP, Annual Fee, Signed Certification Statements.
REAP	Rain Event Action Plan.
RISK LEVEL	As defined by CGP.
QSD	Qualified SWPPP Developer.
QSP	Qualified SWPPP Practitioner.
QRE	Qualifying Rain Event, is an event that produces 0.5 inches of precipitation with a 48 hour or more period between rain events.
SMARTS	Storm Water Multiple Application and Report Tracking System (smarts.waterboard.ca.gov).
SWPPP	Storm Water Pollution Prevention Plan.
SWRCB	State Water Resources Control Board.
WPCD	Water Pollution Control Drawings.
WDID	Waste Discharge Identification Number.

1.05 SUBMITTALS

A. Contractor's QSD shall submit the Notice of Intent and all Permit Registration Documents and the Notice of Intent fee required by SWRCB.

B. Contractor's QSD shall prepare and submit the Storm Water Pollution Prevention Plan for this project to the State Water Resources Control Board (SWRCB) via SMARTS.

C. The Contractor's QSD shall prepare the SWPPP, including the WPCD, Risk Level Determination, and Post Construction Water Balance Calculation. Copies of these documents shall be provided to the Contractor. Contractor at his discretion may accept SWPPP as is, modify it, or develop his own.

D. Contractor shall submit qualifications and experience of the QSD & QSP for Owner's review and acceptance.

E. Contractor shall submit electronic copies of weekly and quarterly inspections, annual reports, compliance certifications, and test results.

F. Contractor shall submit the annual report. The General Permit requires all projects that are enrolled for more than one continuous three-month period to submit information and annually certify that their site is in compliance with these requirements. All dischargers must prepare and electronically submit an annual report no later than September 1 of each year using the Storm water Multi-Application Reporting and Tracking System (SMARTS). The Annual Report must include a summary and evaluation of all sampling and analysis results, original laboratory reports, chain of custody forms, a summary of all corrective actions taken during the compliance year, and identification of any compliance activities or corrective actions that were not implemented.

G. Within 90 days of when construction is complete or ownership has been transferred, the Contractor shall electronically file a Notice of Termination (NOT), a final site map, and photos through the State Water Boards SMARTS system. Filing a NOT certifies that all General Permit requirements have been met.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Storm Water Pollution Prevention Plan: The Contractor's QSD shall provide the quality, grade and type of materials as specified in Stormwater Best Management Practice Handbook, Construction, latest edition, and State Water Resources Control Board (SWRCB) Water Quality Order 2009-0009-DWQ, as amended by 2010-0014-DWQ and 2012-006-DWQ.

B. The Contractor shall have available on-site during construction activities a non-stormwater sampling kit suitable for obtaining storm water and non-stormwater quality grab samples. Kit shall include containers and preservatives appropriate for the pollutants known or expected to be in the stormwater. Required sampling equipment shall be adequate to capture and transport samples to a local ELAP State certified water testing lab.

C. Provide a rain gauge on site to record readings during site inspections.

PART 3 - EXECUTION

3.01 SWPPP IMPLEMENTATION

A. The Contractor shall hire a Qualified SWPPP Practitioner (QSP), as defined by the Construction General Permit, to implement the Storm Water Pollution Prevention Plan to be consistent with the requirements of SWRCB Water Quality Order 2009-0009-DWQ, as amended by 2010-0014-DWQ and 2012-006-DWQ, and as follows:

1) Install perimeter controls and sediment control BMPs prior to starting construction work at the site.

2) Install effective erosion control BMPs at the jobsite.

3) Protect exposed dirt, such as stockpiles, landscaping areas, and hillsides.

4) Properly manage non-storm water discharges such as ground water, broken utility lines and fire hydrant testing per CGP requirements.

5) Contain on-site storm water at the jobsite. Do not drain on-site water directly into the storm drains.

6) QSP to train personnel for the proper implementation of the SWPPP.

7) Revise the SWPPP to suit changing site conditions and also when properly installed systems are ineffective.

8) Adjust BMP's locations and layouts in accordance to construction progress to assure compliance to regulations.

9) Conduct inspections of pollution prevention controls and provide Site Monitoring Report to OAR immediately if pollutants are discharged into the site runoffs. CONTRACTOR shall sample and remediate contaminated water.

10) QSP to develop and implement Rain Event Action Plans (REAPs).

11) QSP to perform and oversee all monitoring consistent with the identified Risk Level for the site.

12) Notification and Report: If pollution occurs in the work area for any reason or when the Contractor becomes aware of any violation of this Section, correct the problem and immediately notify the Inspector. In addition, submit a written report to the Project Civil Engineer within seven (7) calendar days describing the incident and the corrective actions taken. If either the Inspector or Engineer is first to observe pollution or a violation, the Contractor shall also explain in the written report why the Work was inadequately monitored.

13) Revise SWPPP to suit changing site conditions and also when properly installed systems are ineffective.

14) Upon Substantial Completion: Maintain and leave post-construction storm water pollution prevention controls in place and remove those that are not needed as determined by the QSD and OAR.

15) QSP shall submit the annual report. All dischargers must prepare and electronically submit an annual report no later than September 1 of each year using the Storm water Multi-Application Reporting and Tracking System (SMARTS). The Annual Report must include a summary and evaluation of all sampling and analysis results, original laboratory reports, chain of custody forms, a summary of all corrective actions taken during the compliance year, and identification of any compliance activities or corrective actions that were not implemented.

3.02 MONITORING

A. The Contractor shall conduct examination of storm water pollution prevention controls according to the monitoring requirements identified for the projects risk level as defined by the Construction General Permit.

B. The Contractor shall prepare and maintain, at the jobsite, a log of each inspection using Site Monitoring Report forms.

C. The Contractor shall distribute copies of the Owner provided Storm Water Pollution Prevention Plan to their superintendent and subcontractors. At least one (1) copy of the SWPPP shall be available on site at all times.

3.03 SWPPP LIABILITIES AND PENALTIES

A. Review of the inspection logs by the Owner shall not relieve the Contractor from liabilities arising from non-compliance with storm water pollution regulations.

B. Payment of Penalties for non-compliance by the Contractor shall be the sole responsibility of the Contractor and will not be reimbursed by the Owner.

C. Compliance with the Clean Water Act and the State Water Resources Control Board (SWRCB) Water Quality Order 2009-0009-DWQ pertaining to construction activities is the sole responsibility of the Contractor. For any fine(s) levied against the Owner due to non-compliance by the Contractor, the Owner will have the option to either require payment by Contractor of, or deduct from any payments due the Contractor, the total amount of the fine(s) levied on the Owner and associated costs.

3.04 SWPPP CLOSEOUT

A. Verify the following prior to Substantial Completion of SWPPP:

1) Elements of the SWPPP have been completed.

2) Final stabilization of site, as defined by the GCP, has been demonstrated.

3) There is no potential for construction related storm water pollutants to be discharged into site runoff.

4) Construction related equipment and temporary BMPs have been removed from site.

5) Rubbish, debris, and waste materials have been removed and legally disposed of off the Project site.

6) Post-Construction BMP Maintenance Plan has been established.

END OF SECTION 017416

This page intentionally left blank.

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous demolition and construction waste.
2. Recycling nonhazardous demolition and construction waste.
3. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:

1. Section 024116 "Structure Demolition" for disposition of waste resulting from demolition of buildings, structures, and site improvements.
2. Section 024119 "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.
3. Section 042000 "Unit Masonry" for disposal requirements for masonry waste.
4. Section 311000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.

C. Disposal: Removal of demolition and construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 PREINSTALLATION MEETINGS

A. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan including responsibilities of waste management coordinator.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.5 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition and construction waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.6 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan to Owner within seven days of date established for the Notice to Proceed.

1. Use CGBC form "Construction Waste Management (CWM) Plan" or Contractor's comparable form.

1.7 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:

1. Use CGBC form "Construction Waste Management (CWM) Worksheet" or Contractor's comparable form.
2. Material category.
3. Generation point of waste.
4. Total quantity of waste in tons (tonnes).
5. Quantity of waste salvaged, both estimated and actual in tons (tonnes).
6. Quantity of waste recycled, both estimated and actual in tons (tonnes).
7. Total quantity of waste recovered (salvaged plus recycled) in tons (tonnes).
8. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

G. Qualification Data: For waste management coordinator and refrigerant recovery technician.

H. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.8 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, or individual employed and assigned by General Contractor, with a record of successful waste management coordination of projects with similar requirements. Superintendent may serve as Waste Management Coordinator.

1. Firm employs a LEED-Accredited Professional, certified by the USGBC, as waste management coordinator.

B. Refrigerant Recovery Technician Qualifications: Universal certified by EPA-approved certification program.

1.9 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of not less than 50 percent by weight of total nonhazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials.

2.2 REGULATORY REQUIREMENTS

A. Comply with transportation and disposal regulations of authorities having jurisdiction.

B. Comply with applicable provisions in California Integrated Waste Management Act of 1989 (AB 939).

C. Comply with applicable provisions in California Code of Regulations Title 14, Section 18700 et seq.

D. Comply with applicable provisions in "California Green Building Standards Code", California Code of Regulations Title 24, Part 11, Section 5.408.

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged and recycled.
2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

E. Transportation equipment and other materials shall be of sizes that clear surfaces within spaces, areas, rooms, and openings, by not less than 12 inches (300 mm).

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:

1. Clean salvaged items.

2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Sale and Donation: Not permitted on Project site.

C. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

E. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

F. Plumbing Fixtures: Separate by type and size.

G. Lighting Fixtures: Separate lamps by type and protect from breakage.

H. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

3.4 RECYCLING DEMOLITION WASTE

A. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.

B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

1. Pulverize concrete to not more than 1-1/2 inch (38 mm) size.

a. Crush concrete and screen to comply with requirements in Section 312000 "Earthwork" for use as satisfactory soil for fill or subbase.

C. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.

1. Pulverize masonry to not more than 1-1/2 inch (38 mm) size.

a. Crush masonry and screen to comply with requirements in Section 312000 "Earthwork" for use as satisfactory soil for fill or subbase.

2. Clean and stack undamaged, whole masonry units on wood pallets.

D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

E. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.
2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

F. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.

G. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

H. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

I. Metal Suspension System: Separate metal members, including trim and other metals from acoustical panels and tile, and sort with other metals.

J. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.

1. Store clean, dry carpet and pad in a closed container or trailer provided by carpet reclamation agency or carpet recycler.

K. Carpet Tile: Remove debris, trash, and adhesive.

1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by carpet reclamation agency or carpet recycler.

L. Piping: Reduce piping to straight lengths and store by material and size. Separate supports, hangers, valves, sprinklers, and other components by material and size.

M. Conduit: Reduce conduit to straight lengths and store by material and size.

N. Lamps: Separate lamps by type and store according to requirements in 40 CFR 273.

3.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

a. Comply with requirements in Section 329000 "Landscape Planting" for use of clean sawdust as organic mulch.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

a. Comply with requirements in Section 329000 "Landscape Planting" for use of clean ground gypsum board as inorganic soil amendment.

D. Paint: Seal containers and store by type.

3.6 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.

2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

3.7 ATTACHMENTS

A. Appendix A - Sample form "Construction Waste Management (CWM) Plan."

B. Appendix B - Sample form "Construction Waste Management (CWM) Worksheet."

END OF SECTION 017419

Construction Waste Management (CWM) Plan

Note: This sample form may be used to assist in documenting compliance with the waste management plan.

Project Name: _____

Job #: _____

Project Manager: _____

Waste Hauling Company: _____

Contact Name: _____

All Subcontractors shall comply with the project's Construction Waste Management Plan.
All Subcontractor foremen shall sign the CWM Plan Acknowledgment Sheet.

Subcontractors who fail to comply with the Waste Management Plan will be subject to backcharges or withholding of payment, as deemed appropriate. For instance, Subcontractors who contaminate debris boxes that have been designated for a single material type will be subject to backcharge or withheld payment, as deemed appropriate.

1. The project's overall rate of waste diversion will be ____ %.
2. This project shall generate the least amount of waste possible by planning and ordering carefully, following all proper storage and handling procedures to reduce broken and damaged materials and reusing materials whenever possible. The majority of the waste that is generated on this jobsite will be diverted from the landfill and recycled for other use.
3. Spreadsheet 1, enclosed, identifies the waste materials that will be generated on this project, the diversion strategy for each waste type and the anticipated diversion rate.
4. Waste prevention and recycling activities will be discussed at the beginning of weekly subcontractor meetings. As each new subcontractor comes on-site, the WMP Coordinator will present him/her with a copy of the CWM Plan and provide a tour of the jobsite to identify materials to be salvaged and the procedures for handling jobsite debris. All Subcontractor foremen will acknowledge in writing that they have read and will abide by the CWM Plan. Subcontractor Acknowledgment Sheet enclosed. The CWM Plan will be posted at the jobsite trailer.
5. Salvage: Excess materials that cannot be used in the project, nor returned to the vendor, will be offered to site workers, the owner, or donated to charity if feasible.
6. [HAULING COMPANY] will provide a commingled drop box at the jobsite for most of the construction waste. These commingled drop boxes will be taken to [Sorting Facility Name and Location]. The average diversion rate for commingled waste will be ____%. As site conditions permit, additional drop boxes will be used for particular phases of construction (e.g., concrete and wood waste) to ensure the highest waste diversion rate possible.
7. In the event that the waste diversion rate achievable via the strategy described in (6) above, is projected to be lower than what is required, then a strategy of source-separated waste diversion and/or waste stream reduction will be implemented. Source separated waste refers to jobsite waste that is not commingled but is instead allocated to a debris box designated for a single material type, such as clean wood or metal.

   Notes:

   1. Waste stream reduction refers to efforts taken by the builder to reduce the amount of waste generated by the project to below four (4) pounds per square foot of building area.
   2. When using waste stream reduction measures, the gross weight of the product is subtracted from a base weight of four (4) pounds per square foot of building area. This reduction is considered additional diversion and can be used in the waste reduction percentage calculations.
8. [HAULING COMPANY] will track and calculate the quantity (in tons) of all waste leaving the project and calculate the waste diversion rate for the project. [HAULING COMPANY] will provide Project Manager with an updated monthly report on gross weight hauled and the waste diversion rate being achieved on the project. [HAULING COMPANY's] monthly report will track separately the gross weights and diversion rates for commingled debris and for each source-separated waste stream leaving the project. In the event that [HAULING COMPANY] does not service any or all of the debris boxes on the project, the [HAULING COMPANY] will work with the responsible parties to track the material type and weight (in tons) in such debris boxes in order to determine waste diversion rates for these materials.
9. In the event that Subcontractors furnish their own debris boxes as part of their scope of work, such Subcontractors shall not be excluded from complying with the CWM Plan and will provide [HAULING COMPANY] weight and waste diversion data for their debris boxes.
10. In the event that site use constraints (such as limited space) restrict the number of debris boxes that can be used for collection of designated waste the project Superintendent will, as deemed appropriate, allocate specific areas onsite where individual material types are to be consolidated. These collection points are not to be contaminated with non-designated waste types.
11. Debris from jobsite office and meeting rooms will be collected by [DISPOSAL SERVICE COMPANY]. [DISPOSAL SERVICE COMPANY] will, at a minimum, recycle office paper, plastic, metal and cardboard.

This page intentionally left blank.

Construction Waste Management (CWM) Worksheet

Note: This sample form may be used to assist in documenting compliance with the waste management plan.

Project Name: _____

Job Number: _____

Project Manager: _____

Waste Hauling Company: _____

Construction Waste Management (CWM) Plan

WASTE MATERIAL TYPE	DIVERSION METHOD:		PROJECTED DIVERSION RATE
	COMMINGLED AND SORTED OFF SITE	SOURCE SEPARATED ON SITE	
Asphalt			
Concrete			
Shotcrete			
Metals			
Wood			
Rigid insulation			
Fiberglass insulation			
Acoustic ceiling tile			
Gypsum drywall			
Carpet/carpet pad			
Plastic pipe			
Plastic buckets			
Plastic			
Hardiplank siding and boards			
Glass			
Cardboard			
Pallets			
Job office trash, paper, glass & plastic bottles, cans, plastic			
Alkaline and rechargeable batteries, toner cartridges, and electronic devices			
Other:			
Other:			
Other:			
Other:			

This page intentionally left blank.

COMPTON COMMUNITY COLLEGE DISTRICT

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Comply with requirements stated in Conditions of the Contract and in Specifications for administrative procedures in closing out the work.

B. Related Requirements in Other Parts of the Project Manual:

1. Fiscal provisions, legal submittals and additional administrative requirements: Conditions of the Contract.

C. Comply with requirements set forth in General Conditions Article 9.

1.2 SUBSTANTIAL COMPLETION

A. When Contractor considers the work is substantially complete as defined in the General Conditions, he shall submit to Architect/Engineer:

1. A written notice that the work, or designated portion thereof, is substantially complete.

2. A list of items to be completed or corrected.

3. Complete start-up testing of systems, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.

B. When Architect/Engineer concurs that the work is substantially complete, he will:

1. Prepare a letter of Substantial Completion accompanied by Contractor's list of items to be completed or corrected, as verified and amended by the Architect.

2. Submit the Certificate to Owner and Contractor for their written acceptance of the responsibilities assigned to them.

1.3 FINAL INSPECTION

A. When Contractor considers the work is complete, he shall submit written certification that:

1. Contract Documents have been reviewed.

2. Work has been inspected for compliance with Contract Documents.

3. Work has been completed in accordance with Contract Documents.

4. Equipment and systems have been tested in the presence of the Owner's representative and are operational.

5. Work is completed and ready for final inspection.

6. The Architect's/Engineer's final inspection list of items to be completed or corrected, has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Architect/Engineer.

7. Submit consent of surety to final payment.

8. Submit a final liquidated damages settlement statement.

9. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Architect/Engineer will make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.

C. When the Architect/Engineer finds that the work is acceptable under the Contract Documents, he shall request the Contractor to make closeout submittals.

1.4 RECORD DOCUMENT SUBMITTALS

A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Architect's reference during normal working hours.

B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies

substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.

1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.

2. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.

3. Note related Change Order numbers where applicable.

4. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set per Specification 01 78 20 Project Record Documents.

C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and Product Data.

1.5 CLOSEOUT SUBMITTALS

A. Submit the following, where applicable, in accordance with the General Conditions and Specifications:

1. Project record documents.

2. Operation and maintenance data.

3. Warranties, guarantees and bonds.

4. Keys and keying schedule.

5. Spare parts and extra stock.

6. Other items as required by the Specifications.

B. Deliver Certificate of Compliance and Test Report as follows:

1. Sterilization of water systems.

2. Testing of sewer systems.

3. Testing of hot and cold water systems.

4. Testing of gas system.

5. Testing of lighting, power and alarm systems.

6. Testing of HVAC equipment and exhaust fans.

1.6 FINAL APPLICATION FOR PAYMENT

A. Contractor shall submit the final Application for Payment in accordance with procedures and requirements stated in the Conditions of the Contract.

PART 2 – PRODUCTS - (Not Applicable)

PART 3 - EXECUTION

3.1 CLOSEOUT PROCEDURES

A. Operating and Maintenance Instructions: Arrange for each installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of the following items:

1. Maintenance manuals.

2. Record documents.

3. Spare parts and materials.

4. Tools.

5. Identification systems.

6. Control sequences.

7. Hazards.

8. Cleaning.

9. Warranties and bonds.

10. Maintenance agreements and similar continuing commitments.

B. As part of instruction for operating equipment, demonstrate the following procedures:

1. Start-up.

2. Shutdown.

3. Emergency operations.

4. Noise and vibration adjustments.

5. Safety procedures.

6. Economy and efficiency adjustments.

7. Effective energy utilization.

3.2 FINAL CLEANING

A. General: General cleaning during construction is required by the General Conditions and included in Section "Temporary Facilities".

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

1. Complete the following cleaning operations before requesting inspection for Final Completion.

a. Remove labels that are not permanent labels.

b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.

c. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.

d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.

e. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.

C. Pest Control: Engage an experienced exterminator to make a final inspection, and rid the Project of rodents, insects and other pests.

D. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.

E. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.

1. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

END OF SECTION

COMPTON COMMUNITY COLLEGE DISTRICT

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Maintain at the site for the School District, one record copy of:

1. Drawings
2. Specifications
3. Addenda
4. Change Orders and other Modifications to the Contract
5. Architect/Engineer written instructions
6. Approved Shop Drawings, Product Data and Samples.
7. Field Test Records
8. Construction Photographs.

1.2 RELATED SECTIONS

A. General Conditions – 00 72 00

B. Section 01 31 00 - Project Coordination

C. Section 01 33 00 - Submittals

D. Section 01 30 50-31 - Contract Closeout

E. Section 01 72 20 – Field Engineering

1.3 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Store documents and samples in Contractor's field office apart from documents used for construction.

1. Provide files and racks for storage of documents.
2. Provide locked cabinet or secure storage space for storage of samples.

B. File documents and samples in accordance with CSI/CSC Master Format.

C. Maintain documents in a clean, dry legible condition and in good order. Do not use record documents for construction purposes.

D. Make documents and samples available at all times for inspection by School District.

1.4 MARKING DEVICES

A. Provide felt-tip marking pens for recording information in the color code designated by Owner.

1.5 RECORDING

A. Label each document "PROJECT RECORD" in neat, large printed letters.

B. Record information concurrently with construction progress. Do not conceal any work until required information is recorded.

C. Drawings: Legibly mark to record actual construction:

1. Depth of various elements of foundation in relation to finish first floor datum.

2. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

3. Location of internal utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure.

4. Field changes of dimension and detail.

5. Changes made by Addenda, Supplemental Instruction Construction Change Directive or by Change Order.

6. Details not on original contract drawings.

7. Revisions to electrical circuitry and locations of electrical Devices and equipment

8. Identify each record drawing with the written designation of "RECORD DRAWING" in a prominent location.

D. Specifications and Contract Document Modifications: Legibly mark each Section to record:

1. Manufacturer, trade name, catalog number, and Supplier of each Product and item of equipment actually installed.

2. Supplier and Installer's name and contact information.

3. Changes made by Addenda, Supplemental Instructions, and Construction Change Directive or by Change Order.

E. Record Digital Data Files: Immediately before inspection for Substantial Completion, review marked-up record prints with Architect/Engineer, Construction Manager and Project Inspector. When authorized, prepare a full set of corrected digital data files of the Contract Drawings as follows:

1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.

2. Format: Annotated PDF electronic file with comment function enabled.

3. Incorporate changes and additional information previously marked on record prints. Delete, redraw and add new details and notations where applicable.

4. Refer instances of uncertainty to Architect/Engineer (through Construction Manager) for resolution.

5. Architect/Engineer will furnish Contractor one set of digital files of the Contract Drawings, complete on same set, with all Addenda, clarifying Request for Information, Instruction Bulletins, Construction Change Documents, or any other changes, for use in recording information. Digital files shall be in AutoCAD (latest version) and PDF format.

    a. Refer to section 01 33 00 "Submittal Procedures" for requirements related to use of architect's/engineer's digital data files.
    b. Architect/Engineer will provide data file layer information. Record mark-ups in separate layers.

F. Record Drawings Labeling: Provide Hard copy and Digital copy (in PDF format) as follows:

1. Provide a Flash Drive for all Digital Record Drawing submittals with a letter of transmittal describing all contents and date of contents on the Flash Drive.

2. Provide a folder in the Digital submittal labeled in capital letters naming the project i.e. CCC-051 PUBLIC SAFETY BUILDING.

3. Provide sub-folders labeled in capital letters with the category and date of the as-builts i.e. CCC-051 PUBLIC SAFETY BUILDING – AS-BUILTS (CONTRACTORS NAME).

4. Provide separate files in sub-folders labeled with drawing number and description i.e. FA0.0 Title.

5. Submit documents to Architect/Engineer (through the Construction Manager) with claim for final Application for Payment.

6. Final 5% retention will be held until as-builts are complete.

1.6 SUBMITTALS

A. At the completion of the Project, deliver Record Documents to the Compton Community College District (through the Construction Manager). Architect/Engineer shall review documents for compliance with requirements as described above.

B. Accompany submittal with transmittal letter in duplicate, containing:

1. Date

2. Project title and number

3. Contractor's name and address

4. Title and number of each Record Document

5. Signature of Contractor or his authorized representative

C. Prior to the date of Substantial Completion the Contractor is to meet with the architect/engineer to determine which Samples maintained

during construction are to be transferred to the School District. Dispose of all samples not be saved.

PART 2 – PRODUCTS - (Not Applicable)

PART 3 – EXECUTION - (Not Applicable)

END OF SECTION

This page intentionally left blank.

COMPTON COMMUNITY COLLEGE DISTRICT

OPERATING AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for operating and maintenance manuals including the following:

1. Preparation and submittal of operating and maintenance manuals for building operating systems and/or equipment.

2. Instruction of the School District's operating personnel in operation and maintenance of building systems and equipment.

B. Special operating and maintenance data requirements for specific pieces of equipment or building operating systems are included in the appropriate Sections of Divisions 2 through 16.

1. 2 QUALITY ASSURANCE

A. Maintenance Manual Preparation: In preparation of Maintenance Manuals, use personnel thoroughly trained and experienced in operation and maintenance of the equipment or system involved.

1. Where written instructions are required, use personnel skilled in technical writing to the extent necessary for communication of essential data.

2. Where Drawings or diagrams are required, use draftsmen capable of preparing Drawings clearly in an understandable format.

B. Instructions for the School District's Personnel: For instruction of the School District's operating and maintenance personnel, use experienced instructors thoroughly trained and experienced in the operation and maintenance of the building equipment or system involved.

1.3 SUBMITTALS

A. Submittal Schedule: Comply with the following schedule for submittal of operating and maintenance manuals.

1. Before Substantial Completion, when each installation that requires submittal of operating and maintenance manuals is nominally complete, submit two draft copies of each manual to the Architect/Engineer for review. Include a complete index or table of contents of each manual.

B. Form of Submittal: Prepare operating and maintenance manuals in the form of an instructional manual for use by the Owner's operating personnel. Organize into suitable sets of manageable size. Where possible, assemble instructions for similar equipment into a single binder.

1. Binders: For each manual, provide heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, in thickness necessary to accommodate contents, sized to receive 8-1/2" by 11" paper. Provide a clear plastic sleeve on the spine, to hold labels describing the contents. Provide pockets in the covers to receive folded sheets.

a. Where two or more binders are necessary to accommodate data, correlate data in each binder into related groupings in accordance with the Project Manual table of contents. Cross-reference other binders where necessary to provide essential information for proper operation or maintenance of the piece of equipment or system.

b. Identify each binder on the front and spine, with the typed or printed title "OPERATION AND MAINTENANCE MANUAL", Project title or name, and subject matter covered. Indicate the volume number for multiple volume sets of manuals.

2. Protective Plastic Jackets: Provide protective transparent plastic jackets designed to enclose diagnostic software for computerized electronic equipment.

3. Text Material: Where written material is required as part of the manual use the manufacturer's standard printed material, or if it is not available, specially prepared data, neatly typewritten, on 8-1/2" by 11", 20 pound white bond paper.

4. Drawings: Where drawings or diagrams are required as part of the manual, provide reinforced punched binder tabs on the drawings and bind in with the text.

a. Where oversize drawings are necessary, fold the drawings to the same size as the text pages and use as a fold-out.

b. If drawings are too large to be used practically as a fold- out, place the drawing, neatly folded, in the front or rear pocket of the binder. Insert a typewritten page indicating the drawing title, description of contents and drawing location at the appropriate location in the manual.

1.04 MANUAL CONTENT

A. In each manual include information specified in the individual Specification Section, and the following information for each major component of building equipment and its controls:

1. General system or equipment description.

2. Design factors and assumptions.

3. Copies of applicable Shop Drawings and Product Data.

4. System or equipment identification, including:

a. Name of manufacturer.

b. Model number.

c. Serial number of each component.

5. Operating instructions.

6. Emergency instructions.

7. Wiring diagrams.

8. Inspection and test procedures.

9. Maintenance procedures and schedules.

10. Precautions against improper use and maintenance.

11. Copies of warranties.

12. Repair instructions including spare parts listing.

13. Sources of required maintenance materials and related services.

14. Manual Index.

B. Organize each manual into separate Sections for each piece of related equipment. As a minimum each manual shall contain a title page, a table of contents, copies of Product Data, supplemented by drawings and written text, and copies of each warranty, bond and service Contract issued.

1. Title Page: Provide a title page in a transparent plastic envelope as the first sheet of each manual. Provide the following information:

a. Subject matter covered by the manual.

b. Name and address of the Project.

c. Date of submittal.

d. Name, address, and telephone number of the Contractor.

e. Name and address of the Architect;

f. Cross reference to related systems in other operating and maintenance manuals.

2. Table of Contents: After the Title Page, include a typewritten table of contents for each volume.

3. General information: Provide a general information Section immediately following the Table of Contents, listing each product included in the manual, identified by product name. Under each product, list the name, address, and telephone number of the Subcontractor or installer, and the maintenance contractor. Clearly delineate the extent of responsibility of each of these entities. In addition, list a local source for replacement parts and equipment.

4. Product Data: Where manufacturer's standard printed data is included in the manuals, include only sheets that are pertinent to the part or product installed. Mark each sheet to identify each part or product included in the installation.

5. Written Text: Where manufacturer's standard printed data is not available, and information is necessary for proper operation and maintenance of equipment or systems, or it is necessary to provide additional information to supplement data included in the manual, prepare written text to provide necessary information. Organize the text in a consistent format under separate headings for different procedures. Where necessary, provide a logical sequence of instruction for each operating or maintenance procedure.

6. Drawings: Provide specially prepared drawings where necessary to supplement manufacturer's printed data to illustrate the relationship of component parts of equipment or systems, or to provide control or flow diagrams. Coordinate these drawings with information contained in Project Record Drawings to assure correct illustration of the completed installation.

7. Warranties, Bonds and Service Contracts: Provide a copy of each warranty, bond or service contract in the appropriate manual for the information of the Owner's operating personnel. Provide written data outlining procedures to be followed in the event of product failure. List circumstances and conditions that would affect validity of the warranty or bond.

1.05 MATERIAL AND FINISHES MAINTENANCE MANUAL

A. Architectural Products: Provide manufacturer's data and instructions on care and maintenance of architectural products, including applied materials and finishes.

1. Care and Maintenance Instructions: Provide information on care and maintenance, including manufacturer's recommendations for types of cleaning agents to be used and methods of cleaning. Provide information regarding cleaning agents and methods that could prove detrimental to the product. Include manufacturer's recommended schedule for cleaning and maintenance.

B. Moisture-Protection and Weather-Exposed Products: Provide complete manufacturer's data with instructions on inspection, maintenance and repair of products exposed to the weather or designed for moisture-protection purposes.

1.06 EQUIPMENT AND SYSTEMS MAINTENANCE MANUAL

A. Manufacturer's Information: For each manufacturer of a component part or piece of equipment provide the following:

1. Printed operating and maintenance instructions.

2. Assembly drawings and diagrams required for maintenance.

3. List of items recommended to be stocked as spare parts.

B. Maintenance Procedures: Provide information detailing essential maintenance procedures, including the following:

1. Routine operations.

2. Trouble-shooting guide.

3. Disassembly, repair and reassembly

4. Alignment, adjusting and checking.

C. Operating Procedures: Provide information on equipment and system operating procedures, including the following:

1. Start-up procedures.

2. Equipment or system break-in.

3. Routine and normal operating instructions.

4. Regulation and control procedures.

5. Instructions on stopping.

6. Shut-down and emergency instructions.

7. Summer and winter operating instructions.

8. Required sequences for electric or electronic systems.

9. Special operating Instructions.

D. Servicing Schedule: Provide a schedule of routine servicing and lubrication requirements, including a list of required lubricants for equipment with moving parts.

E. Controls: Provide a description of the sequence of operation and as-installed control diagrams by the control manufacturer for systems requiring controls.

F. Coordination Drawings: Provide each Contractor's Coordination Drawings.

1. Provide as-installed color-coded piping diagrams, where required for identification.

G. Valve Tags: Provide charts of valve tag numbers, with the location and function of each valve.

H. Circuit Directories: For electric and electronic systems, provide complete circuit directories of panel boards, including the following:

1. Electric service.

2. Controls.

3. Communication.

1.07 INSTRUCTIONS TO SCHOOL DISTRICT PERSONNEL

A. Prior to final inspection, instruct School District personnel in operation, adjustment, and maintenance of products, equipment and systems. Provide instruction at mutually agreed upon times.

1. For equipment that requires seasonal operation, provide similar instruction during other seasons.

2. Use operation and maintenance manuals for each piece of equipment or system as the basis of instruction. Review contents in detail to explain all aspects of operation and maintenance.

PART 2 – PRODUCTS - (Not Applicable)

PART 3 – EXECUTION - (Not Applicable)

END OF SECTION

This page intentionally left blank.

COMPTON COMMUNITY COLLEGE DISTRICT

COMMISSIONING

PART 1 – GENERAL

1.1 SUMMARY

A. Commissioning is a process for validating and documenting that the facility and its systems are constructed and perform in conformity with the Contract Documents.

B. The objective of the commissioning process is to verify that the performance of the facility and its systems meet or exceed the design intent.

C. Commissioning includes special facility start-up processes used to bring the facility to a fully operational state, free of deficiencies in an efficient and timely manner

D. Training on related systems and equipment operation and maintenance shall be scheduled to commence only after start-up is complete and systems are verified to be 100% complete and functional.

1.2 DESCRIPTION

A. The following applies to all Contract Documents

1. Contractor Startup: Sub-phase of Contractor's work ending with Acceptance of Work, during which Contractor performs a pre-planned program of activities including starting, testing, inspecting, adjusting balancing, correcting deficiencies and other similar activities.

    a. The Construction Manager, Architect/Engineer, Consultants and the DSA Inspector of Record (IOR) shall be present to observe, inspect and identify deficiencies in Building Systems Operations.

2. The completion of startup means the entire Construction Project including startup and fine tuning has been performed to the requirements of the Contract Documents and is verified in writing by the Construction Manager, Architect/Engineer and the Consultants.

3. Fine Tuning: Fine tuning is the responsibility of Contractors after District occupancy and ending one year after District occupancy. During this time the Contractor is responsible for optimizing systems and correcting deficiencies arising under normal operating conditions.

    a. Includes a period after occupancy where systems are optimized under "live" operating conditions and any outstanding construction deficiencies are corrected.

    b. Fine Tuning shall extend from date of District occupancy to one year after occupancy.

1.3 RELATED SECTIONS – (Not Applicable)

1.4 DEFINITION OF TERMS

A. Contractor's Pre-Commissioning Checklists: Includes installation and start-up items as specified to be completed by the appropriate contractors prior to operational verification through the functional testing process.

B. Installation Verification Process: Includes the on-site inspection and review of related system components for conformance to Contract Documents. The Contractor shall verify systems readiness for functional testing procedures prior to the start of functional testing. Deficiencies will be documented by the Inspector for future resolution.

C. Functional Performance Testing Process: Includes the documented testing of system parameters, under actual or simulated operating conditions. Final performance commissioning of systems will begin only after the appropriate Contractor certifies that systems are 100% complete and ready for functional testing. The contractors will be required to schedule, coordinate and perform device tests, calibration and functional performance test procedures.

D. Deficiencies and Resolutions List: Includes a list of noted deficiencies discovered as a result of the commissioning process. This list also includes the current disposition of issues, and the date of final resolution as confirmed by the Construction Manager and Inspector. Deficiencies are defined as those issues where products execution or performance does not satisfy the Project Contract Documents and/or the design intent.

1.5 COMMISSIONING SCHEDULE

A. Provide schedules for Contractor Start-Up work.

B. Incorporate in overall construction schedule.

C. Contractor's activities, which will be performed as specified under Fine Tuning, shall be completed within one year from date of occupancy by the District.

1.6 SUBMITTALS

A. Submit Draft and Final Contractor Start-up Forms as described in this Section. Submit Draft Report for Construction Manager and Architect's review and comment prior to Final Submission.

B. Prepare and submit one copy of report form to be used in preparation of system reports for:

1. Each mechanical system as required

2. Each Electrical & low voltage system as required.

C. Each System Report shall be submitted including the following:

1. Project Name

2. Name of System

3. Manufacturer's equipment start-up reports.

4. Systems' testing, balancing, and adjusting reports.

5. Equipment Report Forms shall include the following: Project name, name of equipment, starting and testing procedures to be performed and observations and test results to be recorded.

1.7 COMMISSIONING DUTIES AND RESPONSIBILITIES

A. Contractors Duties and Responsibilities:

1. Assure the participation and cooperation of Subcontractors and Suppliers under their jurisdictions as required to complete the commissioning process.

2. Complete Commissioning Report Forms. Reports are to be completed in a neat easily readable condition.

3. Complete the respective start-up and check out procedures and insure readiness of equipment and systems prior to the start of the functional performance testing.

   Written confirmation of system readiness for performance testing is required.

4. Provide qualified representatives for the functional performance commissioning process.

5. Assure that all subcontractors, suppliers, test and balance, controls, etc. include in there respective contracts cost necessary to participate in and complete the commissioning process.

B. Duties and responsibilities of others for Commissioning:

1. The commissioning process requires the active participation of the Construction Manager, School District, Mechanical Engineer, Electrical Engineer, and any other related Consultants on the project.

1.8 SYSTEM FAILURES

A. After a second failure of a system to successfully meet the criteria as set for in the functional performance testing process, the contractor shall reimburse the School District for cost associated with any additional retesting required due to uncorrected deficiencies. Costs shall include salary, benefits, overhead, travel costs and per diem lodging costs if applicable.

PART 2 – PRODUCTS - (Not Applicable)

PART 3 – EXECUTION - (Not Applicable)

END OF SECTION

ASBESTOS ABATEMENT PROJECT SPECIFICATIONS

For:

EL CAMINO COLLEGE CENTER
BUILDINGS E, F, G, M1 AND M2
1111 EAST ARTESIA BOULEVARD
COMPTON, CALIFORNIA 90221

PRESENTED TO:

Compton Community College District
1111 East Artesia Boulevard
Compton, California 90221

PRESENTED BY:

BAINBRIDGE
Environmental Consultants

1322 Bell Avenue, Suite 1N
Tustin, CA 92780
Phone: 714-247-0024
Fax: 714-247-0025

Bainbridge Project # 17015810.20
January 22, 2017

SECTION 02080 - ASBESTOS ABATEMENT

PART 1 – GENERAL

The work required to be performed by the Contractor comprises the following:

Project Title: El Camino College Center – Buildings E, F, G, M1 and M2
Client: Compton Community College District
Location: 1111 East Artesia Boulevard, Compton, California 90221

1.1 WORK DESCRIPTION

The work included consists of furnishing labor, materials, permits, equipment, services, insurance including but not limited to the handling and transportation and disposal of asbestos- containing materials and waste resulting from the removal of asbestos-containing materials in various areas. This work shall be conducted by a licensed abatement contractor and certified personnel in accordance with all applicable Federal, State, and local regulations.

A. Materials and their quantities to be abated shall be verified by the General Contractor/Abatement Contractor prior to the abatement work. Abatement work shall be cross-referenced and shall be coordinated with Compton Community College District. Refer to Bainbridge's Comprehensive Asbestos and Lead- Based Paint Survey Report for El Camino College Center – Buildings E, F, G, M1 and M2 dated January 22, 2017 for a full and complete description of the materials and locations surveyed. The asbestos-containing materials to be abated and their general location(s) and estimated quantities are follows:

BUILDING E:
Asbestos

Sample No.	Sample Location	Sample Description/Color	Material Location	Approx. Quantity	Laboratory Results
16 Tar	Building E Roof (East Side)	Pipe Mastic/Gray	Pipe Mastic T/O	75 Sq. Ft.	7% Chrysotile
17 *Tar*	Building E Roof (East Side)	Pipe Mastic/ Gray	See Above	I/A	3% Chrysotile
19 *Tar Mastic*	Building E Roof (East Side)	Curb Mastic/ Gray	Curb Mastic T/O	75 Sq. Ft.	3% Chrysotile
28 *Floor Tile*	Building E Room E-56 (Closet)	9"x 9" Floor Tile with Mastic/ Black	9"x 9" Floor Tile with Mastic T/O	100 Sq. Ft.	6% Chrysotile

T/O = Throughout I/A = Included Above

BUILDING E:
Asbestos

Sample No.	Sample Location	Sample Description/Color	Material Location	Approx. Quantity	Laboratory Results
29 *Floor Tile*	Building E Room E-56 (Closet)	9”x 9” Floor Tile with Mastic/ Black	See Above	I/A	6% Chrysotile
30 *Floor Tile*	Building E Room E-56 (Closet)	9”x 9” Floor Tile with Mastic/ Black	See Above	I/A	8% Chrysotile
31 *Floor Tile*	Building E Room E-54	9”x 9” Floor Tile with Mastic/ Green	9”x 9” Floor Tile with Mastic T/O	1,300 Sq. Ft.	10% Chrysotile
32 *Floor Tile*	Building E Room E-52	9”x 9” Floor Tile with Mastic/ Green	See Above	I/A	10% Chrysotile
33 *Floor Tile*	Building E Room E-50	9”x 9” Floor Tile with Mastic/ Green	See Above	I/A	8% Chrysotile
34 *Floor Tile*	Building E Room E-52	9”x 9” Floor Tile with Mastic/ Brown	9”x 9” Floor Tile with Mastic T/O	1,000 Sq. Ft.	8% Chrysotile

T/O = Throughout I/A = Included Above

BUILDING E:
Asbestos

Sample No.	Sample Location	Sample Description/Color	Material Location	Approx. Quantity	Laboratory Results
35 *Floor Tile*	Building E Room E-52	9”x 9” Floor Tile with Mastic/ Brown	See Above	I/A	8% Chrysotile
36 *Floor Tile*	Building E Room E-50	9”x 9” Floor Tile with Mastic/ Brown	See Above	I/A	8% Chrysotile
46	Building E Upper Roof (South Side)	Window Putty/ Blue	Window Putty T/O	5,500 Lin. Ft.	5% Chrysotile
47	Building E Upper Roof (South Side)	Window Putty/ Blue	See Above	I/A	4% Chrysotile
48	Building E Room E-31 Exterior (South Side)	Window Putty/ Blue	See Above	I/A	3% Chrysotile
52 *Base Cove*	Building E Room E-52	Base Cove with Mastic/Green	Base Cove with Mastic T/O	150 Lin. Ft.	8% Chrysotile
52 *Mastic*	Building E Room E-52	Base Cove with Mastic/ Green	Base Cove with Mastic T/O	150 Lin. Ft.	2% Chrysotile

T/O = Throughout I/A = Included Above

BUILDING E:
Asbestos

Sample No.	Sample Location	Sample Description/Color	Material Location	Approx. Quantity	Laboratory Results
53 *Base Cove*	Building E Room E-52	Base Cove with Mastic/ Green	See Above	I/A	8% Chrysotile
53 *Mastic*	Building E Room E-52	Base Cove with Mastic/ Green	See Above	I/A	2% Chrysotile
54 *Base Cove*	Building E Room E-52	Base Cove with Mastic/ Green	See Above	I/A	10% Chrysotile
54 *Mastic*	Building E Room E-52	Base Cove with Mastic/ Green	See Above	I/A	2% Chrysotile
64 *Floor Tile*	Building E Room E-55	12”x 12” Floor Tile with Mastic/ Brown with Red Streaks	12”x 12” Floor Tile with Mastic T/O	75 Sq. Ft.	5% Chrysotile
64 *Mastic*	Building E Room E-55	12”x 12” Floor Tile with Mastic/ Brown with Red Streaks	12”x 12” Floor Tile with Mastic T/O	75 Sq. Ft.	5% Chrysotile
65 *Floor Tile*	Building E Room E-55	12”x 12” Floor Tile with Mastic/ Brown with Red Streaks	See Above	I/A	5% Chrysotile
66 *Floor Tile*	Building E Room E-55	12”x 12” Floor Tile with Mastic/ Brown with Red Streaks	See Above	I/A	8% Chrysotile

T/O = Throughout I/A = Included Above

BUILDING E:
Asbestos

Sample No.	Sample Location	Sample Description/Color	Material Location	Approx. Quantity	Laboratory Results
70	Building E Roof (South Side)	Transite Pipe/ Gray	Transite Pipe T/O	100 Lin. Ft.	20% Chrysotile
71	Building E Roof (South Side)	Transite Pipe/ Gray	See Above	I/A	15% Chrysotile 3% Crocidolite
72	Building E Roof (South Side)	Transite Pipe/ Gray	See Above	I/A	15% Chrysotile 4% Crocidolite
96	Building E Room E-55 (Exterior)	Window Putty/ White	See Above	I/A	2% Chrysotile
130	Building E Crawl Space Entrance	Damper/ White	Damper T/O	50 Sq. Ft.	35% Chrysotile

T/O = Throughout I/A = Included Above

BUILDING E:

Asbestos

Sample No.	Sample Location	Sample Description/Color	Material Location	Approx. Quantity	Laboratory Results
131	Building E Crawl Space Entrance	Damper/ White	See Above	I/A	40% Chrysotile
132	Building E Crawl Space Entrance	Damper/ White	See Above	I/A	35% Chrysotile

T/O = Throughout I/A = Included Above

BUILDING F:

Asbestos

Sample No.	Sample Location	Sample Description/Color	Material Location	Approx. Quantity	Laboratory Results
154	Building F Roof (East Side)	Pipe Mastic/ Gray	Pipe Mastic T/O	25 Sq. Ft.	1% Chrysotile
155	Building F Roof (North Side)	Pipe Mastic/ Gray	See Above	I/A	1% Chrysotile
156	Building F Roof (North Side)	Pipe Mastic/ Gray	See Above	I/A	1% Chrysotile
184	Building F Upper Roof (South Side)	Window Putty/ Blue	Window Putty T/O	5,500 Lin. Ft.	2% Chrysotile
185	Building F Room F-39 (Exterior)	Window Putty/ Blue	See Above	I/A	2% Chrysotile
186	Building F Room F-32 (Exterior)	Window Putty/ Blue	See Above	I/A	2% Chrysotile
197	Building F Room F-12B	Lab Countertop/ Black	See Above	I/A	20% Chrysotile

T/O = Throughout I/A = Included Above

BUILDING F:

Asbestos

Sample No.	Sample Location	Sample Description/Color	Material Location	Approx. Quantity	Laboratory Results
199 *Gray Terrazzo*	Building F Women's Staff Restroom (Wall)	Terrazzo/ Multi	Terrazzo T/O	2,000 Sq. Ft.	<1% Chrysotile

T/O = Throughout I/A = Included Above

BUILDING F:

Asbestos

Sample No.	Sample Location	Sample Description/Color	Material Location	Approx. Quantity	Laboratory Results
201 *Gray Terrazzo*	Building F Men's Staff Restroom (Wall)	Terrazzo/ Multi	See Above	I/A	<1% Chrysotile
202 *Base Cove*	Building F Room F-39	Base Cove with Mastic/ Green	Base Cove with Mastic T/O	150 Lin. Ft.	4% Chrysotile
202 *Mastic*	Building F Room F-39	Base Cove with Mastic/ Green	Base Cove with Mastic T/O	150 Lin. Ft.	2% Chrysotile
203 *Base Cove*	Building F Room F-39	Base Cove with Mastic/ Green	See Above	I/A	5% Chrysotile
203 *Mastic*	Building F Room F-39	Base Cove with Mastic/ Green	See Above	I/A	2% Chrysotile
204 *Base Cove*	Building F Room F-39	Base Cove with Mastic/ Green	See Above	I/A	8% Chrysotile
204 *Mastic*	Building F Room F-39	Base Cove with Mastic/ Green	See Above	I/A	2% Chrysotile
211	Building F Roof (South Side)	Transite Pipe/ Gray	Transite Pipe T/O	75 Lin. Ft.	25% Chrysotile 10% Crocidolite
212	Building F Roof (South Side)	Transite Pipe/ Gray	See Above	I/A	25% Chrysotile 2% Crocidolite
213	Building F Roof (South Side)	Transite Pipe/ Gray	See Above	I/A	25% Chrysotile 10% Crocidolite
217 *Floor Tile*	Building F Room F-33	9"x 9" Floor Tile with Mastic/ Black	9"x 9" Floor Tile with Mastic T/O	1,000 Sq. Ft.	5% Chrysotile
218 *Floor Tile*	Building F Room F-33	9"x 9" Floor Tile with Mastic/ Black	See Above	I/A	5% Chrysotile
219 *Floor Tile*	Building F Room F-33	9"x 9" Floor Tile with Mastic/ Black	See Above	I/A	3% Chrysotile
235 *Floor Tile*	Building F Room F-39	9"x 9" Floor Tile with Mastic/ Green	9"x 9" Floor Tile with Mastic T/O	600 Sq. Ft.	5% Chrysotile
236 *Floor Tile*	Building F Room F-39	9"x 9" Floor Tile with Mastic/ Green	See Above	I/A	5% Chrysotile
237 *Floor Tile*	Building F Room F-39	9"x 9" Floor Tile with Mastic/ Green	See Above	I/A	6% Chrysotile

T/O = Throughout I/A = Included Above

BUILDING F:

Asbestos

Sample No.	Sample Location	Sample Description/Color	Material Location	Approx. Quantity	Laboratory Results
238 Floor *Tile*	Building F Room F-39	9"x 9" Floor Tile with Mastic/ Brown	9"x 9" Floor Tile with Mastic T/O	600 Sq. Ft.	4% Chrysotile
239 *Floor Tile*	Building F Room F-39	9"x 9" Floor Tile with Mastic/ Brown	See Above	I/A	4% Chrysotile
240 *Floor Tile*	Building F Room F-39	9"x 9" Floor Tile with Mastic/ Brown	See Above	I/A	6% Chrysotile
241 *Floor Tile*	Building F Room F-32	12"x 12" Floor Tile with Mastic/ White	12"x 12" Floor Tile with Mastic T/O	1,200 Sq. Ft.	2% Chrysotile
242 *Floor Tile*	Building F Room F-32	12"x 12" Floor Tile with Mastic/ White	See Above	I/A	2% Chrysotile
243 *Floor Tile*	Building F Room F-32	12"x 12" Floor Tile with Mastic/ White	See Above	I/A	3% Chrysotile
243 *Mastic 2*	Building F Room F-32	12"x 12" Floor Tile with Mastic/ White	See Above	I/A	5% Chrysotile

T/O = Throughout I/A = Included Above

BUILDING G:

Asbestos

Sample No.	Sample Location	Sample Description/Color	Material Location	Approx. Quantity	Laboratory Results
340 *Floor Tile*	Building G Room G-33	9"x 9" Floor Tile with Mastic/ Multi-Brown	9"x 9" Floor Tile with Mastic T/O	350 Sq. Ft.	3% Chrysotile
340 *Mastic*	Building G Room G-33	9"x 9" Floor Tile with Mastic/ Multi-Brown	9"x 9" Floor Tile with Mastic T/O	350 Sq. Ft.	4% Chrysotile
341 *Floor Tile*	Building G Room G-39 Break Room	9"x 9" Floor Tile with Mastic/ Multi-Brown	See Above	I/A	4% Chrysotile
341 *Mastic*	Building G Room G-39 Break Room	9"x 9" Floor Tile with Mastic/ Multi-Brown	See Above	I/A	4% Chrysotile
342 *Floor Tile*	Building G Room G-39 Break Room	9"x 9" Floor Tile with Mastic/ Multi-Brown	See Above	I/A	3% Chrysotile
342 *Mastic*	Building G Room G-39 Break Room	9"x 9" Floor Tile with Mastic/ Multi-Brown	See Above	I/A	4% Chrysotile

T/O = Throughout I/A = Included Above

BUILDING G:

Asbestos

Sample No.	Sample Location	Sample Description/Color	Material Location	Approx. Quantity	Laboratory Results
382	Building G Upper Roof (South Side)	Window Putty/ Blue	Window Putty T/O	3,000 Lin. Ft.	2% Chrysotile
391	Building G Roof (South Side)	Transite Pipe/ Gray	Transite Pipe T/O	50 Lin. Ft.	10% Chrysotile 5% Crocidolite
392	Building G Roof (South Side)	Transite Pipe/ Gray	See Above	I/A	10% Chrysotile 8% Crocidolite
393	Building G Roof (South Side)	Transite Pipe/ Gray	See Above	I/A	15% Chrysotile 5% Crocidolite

T/O = Throughout I/A = Included Above

BUILDING M2:

Asbestos

Sample No.	Sample Location	Sample Description/Color	Material Location	Approx. Quantity	Laboratory Results
433	Building M-2 Roof (South Side)	Roofing Silicone/ White	Roofing Silicone T/O	1,250 Sq. Ft.	4% Chrysotile
434	Building M-2 Roof (North Side)	Roofing Silicone/ White	See Above	I/A	3% Chrysotile
435	Building M-2 Roof (East Side)	Roofing Silicone/ White	See Above	I/A	4% Chrysotile

T/O = Throughout I/A = Included Above

EPA 600/R-93/116 1,000 POINT COUNT Procedure Results:

BUILDING F:

Asbestos

Sample No.	Sample Location	Sample Description	Color	Material Location	Approx. Quantity	Laboratory Results
154	Building F Roof (East Side)	Pipe Mastic	Gray	Pipe Mastic T/O	25 Sq. Ft.	0.2 Chrysotile
155	Building F Roof (North Side)	Pipe Mastic	Gray	See Above	I/A	0.1 Chrysotile
156	Building F Roof (North Side)	Pipe Mastic	Gray	See Above	I/A	0.3 Chrysotile
199 *Gray Terrazzo*	Building F Women's Staff Restroom (Wall)	Terrazzo	Multi	Terrazzo T/O	2,000 Sq. Ft.	<0.1% Chrysotile
201 *Gray Terrazzo*	Building F Men's Staff Restroom	Terrazzo	Multi	See Above	I/A	0.2% Chrysotile

In the event that other materials are found to be similar or homogenous to the materials sampled, and determined to contain asbestos, those similar or homogenous materials will be considered assumed asbestos containing materials. Prior to bid, contractor is responsible for field verification of all identified and/or assumed asbestos-containing materials, their quantities and measurements.

B. Asbestos abatement observation services shall be conducted by a third party consultant and shall be contracted directly by Compton Community College District.

C. All applicable codes and regulations revised and updated are made part of these specifications by reference herewith.

1. Code of Federal Regulations (CFR):

40 CFR Part 763	Asbestos Containing Materials In Schools
29 CFR 1910.1001	Occupational Exposure to Asbestos, Tremolite, Anthophyllite and Actinolite
29 CFR 1910.1101	Asbestos
29 CFR 1910.1200	Hazard Communication
29 CFR 1910.20	Access to Employee Exposure and Medical Records
29 CFR 1910.132	General Requirements - Personal Protective Equipment
29 CFR 1910.133	Eye and Face Protection
29 CFR 1910.134	Respiratory Protection
29 CFR 1910.145	Specifications for Accident Prevention, Signs and Tags
29 CFR 1926.1101	Asbestos Standard for construction Industry
40 CFR 61	Sub-part A General Conditions
40 CFR 61	Sub-part M National Emission Standards for Asbestos
40 CFR 61.152	Standard for Waste Disposal for Manufacturing, Demolition, Renovation, Spraying and Fabrication Operations

2. U. S. Environmental Protection Agency (EPA):

Publication No.	
560/5-85-024	Guidance for Controlling Asbestos-Containing Materials in Buildings

3. National Institute of Occupational Safety and Health (NIOSH):
Manual of Analytical Methods, 2nd Ed., Vol. 1.
Physical and Chemical Analysis Method (P&CAM):
Method 239, Asbestos Fibers in Air
Method 7400, Fibers (N1, 3rd Ed., Vol. 1.)

4. American National Standard Institute (ANSI):

Z9.2-1979	Fundamentals Governing The Design and Operation of Local Exhaust Systems
Z88.2-1980	Practices for Respiratory Protection

5. National Fire Protection Association (NFPA):

Standard 90A	Installation of Air Conditioning and Ventilation Systems.

6. American Society for Testing Materials (ASTM):

E 849-82	Safety and Health Requirements Relating to Occupational Exposures to Asbestos
P-189	Specifications for Encapsulants for Friable Asbestos-Containing Materials

7. Underwriters Laboratories, Inc. (UL):

586-77 (R1982)	Test Performance of High Efficiency, Particulate, Air Filter Units

8. Title 8 California Code of Regulations (CCR):

Section 1529	Asbestos
Section 5208	General Industry Safety Orders
Section 5144	Respirator Regulations

9. South Coast Air Quality Management District – Rule 1403

10. Local and other regulations

1.2 CONTRACTOR'S QUALITY ASSURANCE

A. Safety Compliance: In addition to detailed requirements of this specification, comply with laws, ordinances, rules, and regulations of federal, state, regional, and local authorities and publications regarding handling, storing, transporting, and disposing of asbestos waste materials. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting the work. Where the requirements of this specification and referenced documents vary, the most stringent requirement shall apply.

B. Contractor shall have at least one copy each of 29 CFR Part 1910 - Occupational Safety and Health Standards, 29 CFR 1926.1101, 40 CFR Part 61, sub-parts A & M, and all pertinent state and local regulations at his office and at the job site.

C. Before the commencement of any work at the site, the contractor shall post EPA and OSHA caution signs in and around the work area to comply with EPA and OSHA regulations.

D. Personal monitoring and other monitoring, which are required by law, or considered necessary by the Contractor for worker protection shall be the responsibility of the Contractor.

E. Area monitoring will be performed by the Observation Service. A predetermined number of air samples will be collected at various stages of the Work, in designated places inside and outside the Work areas.

1.3 SUBMITTALS AND NOTIFICATIONS

A. At the pre-construction meeting, Contractor shall submit (1) declaration certifying that all Contractor's employees have been adequately trained, and (2) a photocopy of training certificates for each employee from their respective training agency or organization. When certified or other formal worker training is required by state or local agencies, Contractor may submit a photocopy of the employee's asbestos worker certification card in lieu of training certificates.

B. Submit at Pre-construction Meeting manufacturer's certification that the respirators to be used in this Project comply with government agency requirements. Contractor's certifications for each employee must clearly state that each employee has been fit tested and properly trained for respirators.

C. Submit proof that all persons providing labor and/or professional services who will be entering abatement work areas have had current (less than one year prior to the date of their participation on the Project) medical examinations. Furnish physician's interpretation of said examinations to the State on the Certificate of Medical Compliance form provided in the Supplementary General Conditions section of these Construction Documents at the Pre-construction Meeting, or prior to that person's commencing work on this Project, and for each person subsequently providing labor and/or professional services at the job site for whom a certificate was not initially furnished. Refer to Article 3.5, A. NOTE: In lieu of the above certificate, current medicals will be acceptable providing that a statement in the medical exam declares that the worker can wear a negative pressure respirator while performing their work. Contractor shall resubmit physician's interpretation of medical examination for each worker or professional employed by him whose physician or regulatory required annual or employment termination examination becomes due while said worker or professional is participating in the Project. This requirement can be waived or modified only by COMPTON COMMUNITY COLLEGE DISTRICT in writing or verbally, followed up in writing.

D. Immediately after Contractor has received the COMPTON COMMUNITY COLLEGE DISTRICT’s Notice of Award, submit manufacturer's catalogue, samples, Material Data Safety Sheets, (MSDS) and other items needed to demonstrate the quality of the proposed abatement materials. Under no circumstances shall proposed materials be used before written approval from

COMPTON COMMUNITY COLLEGE DISTRICT, COMPTON COMMUNITY COLLEGE DISTRICT's Representative or Observation Service. Submittals are required if the following materials are proposed:

1. Encapsulant
2. Surfactant
3. Protective packaging
4. Lagging adhesive
5. Glove bags
6. Resaturant
7. Solvents

E. Submit at Pre-construction Meeting proof satisfactory to COMPTON COMMUNITY COLLEGE DISTRICT, or the Observation Service that all required permits have been obtained and notifications have been sent. Contact and notify the following government agencies in writing ten working days prior to the commencement of Work:

1. EPA Regional Asbestos Coordinator,
2. Occupational Safety and Health Administration,
3. Local Air Quality Management District,
4. Local Fire Department if required,

All notifications shall contain as a minimum the following information:

1. Name, address and telephone number of COMPTON COMMUNITY COLLEGE DISTRICT including the contact person.
2. Name, address, EPA numbers, license number and telephone number of the Contractor including the contact person.
3. Name, address and description of the building, including size, age, and prior use of building.
4. The type and quantity of asbestos material involved and the description of the Work.
5. Scheduled starting and completion dates for Abatement Work.

6. Procedures that shall be employed to comply with the regulations.

7. The name, address, EPA number and telephone number of the Transporter.

8. The name and address of the Hazardous Waste Disposal Facility where the Asbestos Waste shall be deposited.

F. Submit at Pre-Construction Meetings copies of all government agency correspondence and proof of delivery. No work shall commence until verification of required notifications is made by the Observation Service.

G. Submit at Pre-construction Meeting the method of transport of hazardous and non-hazardous waste, including the name, address, EPA ID number, and telephone number of the transporter(s).

H. Submit for approval at the Pre-construction Meeting the name, address, EPA ID number, and telephone number of the hazardous and non-hazardous waste disposal facility(s) to be used.

I. Submit at the Pre-construction Meeting for approval a detailed plan of the work procedures to be used in the abatement of the asbestos-containing materials. The asbestos plan must be approved in writing by the Observation Service and COMPTON COMMUNITY COLLEGE DISTRICT before the start of any work, including work mobilization. The plan shall include:

1. Location of Asbestos Work Areas.

2. Layout and construction details of Decontamination Enclosure Systems.

3. Project schedule including critical paths, interface of other trades, and completion dates of abatement stages and work areas.

4. Personal air monitoring procedures.

5. Detailed description of the method to be employed in order to control pollution, including negative air equipment calculations.

6. Names of Superintendent, Foremen, Project Manager and other key personnel, and their day time, emergency telephone numbers and pagers.

7. Security Plan including sketches necessary to clearly describe the plan.

8. Emergency evacuation plan for injured workers, compressor failure, fire and other emergencies.

J. Submit at Pre-construction Meeting manufacturer's certification that vacuums, equipment filters, and other local exhaust ventilation equipment conform to ANSI Z9.2-1979.

K. Provide proof of Contractor's License and Asbestos Certification from the Contractor Licensing Board, and proof of registration with the Division of Occupational Safety and Health in accordance with California Labor Code, Section 6501.

PART 2 - PRODUCTS

2.1 GENERAL

A. Contractor shall furnish, provide and utilize the following products in the Work as specified herein.

B. The Work is based on the materials, equipment and methods described in these specifications. COMPTON COMMUNITY COLLEGE DISTRICT or the Observation Service will consider proposals for substitutions of materials and equipment only when such proposals are accompanied by written technical product data.

C. No materials or equipment shall be substituted unless approved in writing by COMPTON COMMUNITY COLLEGE DISTRICT or the Observation Service.

2.2 PROTECTIVE COVERING (PLASTIC) AND DISPOSAL BAGS

A. Shall be fire retardant plastic or equivalent with a thickness of ten mil, six mil, four mil and three mil polyethylene sheets. Disposal bags shall be pre-printed with labels as required by CFR 40 Part 60 or applicable CAL-OSHA requirements.

2.3 TAPE AND GLUE

A. Duct Tape 2" or wider, or equal, and capable of sealing joints of adjacent sheets of plastic, and for attachment of plastic sheet to finished or unfinished surfaces of dissimilar materials. The bonding strength and seal must not be affected by mist, water, encapsulating agent or any other materials used in the work.

2.4 PROTECTIVE PACKAGING

A. Appropriately labeled clear, double six (6) mil sealable polyethylene bags as a minimum.

B. Bilingual labels (English and other appropriate language) on containment glove bags, waste packages, contaminated material packages and other containers shall be in accordance with EPA or OSHA standards.

2.5 WARNING LABELS AND SIGNS

A. As required by 29 CFR 1910.1001, 29 CFR 1910.1200, 29 CFR 1926.58 and other pertinent state and local codes and regulations.

2.6 WETTING AGENT OR SURFACTANT

A. Surfactant, or wetting agent, for amending water will be 50 percent polyoxyethylene polyglycol ether and 50 percent polyoxyethylene ether, or equivalent, at a concentration of one (1) ounce per five (5) gallons of water. The material must be odorless, non-flammable, non-toxic, non-irritant and non-carcinogenic.

2.7 ENCAPSULATING SEALER

A. Shall be a penetrating or bridging type, pollution-free, water based, nontoxic, with a Class A fire classification as specified herein. Encapsulants with the ingredient Methylene Chloride are not acceptable unless the contractor can prove to COMPTON COMMUNITY COLLEGE DISTRICT's satisfaction that equal substitute materials are not available. If substitutes are not used, the Contractor shall submit with the asbestos plan, for approval, respiratory protection and negative air discharge procedures to protect workers, authorized personnel and the public from Methylene Chloride exposure. Material shall be flexible when cured, resistant to weathering, oxidation, aging and abuse.

2.8 LAGGING ADHESIVE

A. Shall meet NFPA 90A Code, such as Arabol, Childers CP52, Insul-Coustic 102, or approved equal.

2.9 TOOLS AND EQUIPMENT

A. Provide suitable tools for asbestos removal and encapsulation.

B. HEPA vacuums shall comply with ANSI Z9.2-1979

C. Ladders and scaffolds shall be of required OSHA dimensions and quantities so that all work surfaces can be easily and safely accessed.

D. Electrical equipment shall be UL-listed and approved, and shall have ground-fault interrupt.

E. Airless spray equipment shall have a nozzle pressure with an adjustable range of 400-1500 psi.

PART 3 - REQUIREMENTS FOR WORKER PROTECTION

3.1 TRAINING PROGRAM

A. Each employee shall receive training in the proper handling of materials that contain asbestos, including all aspects of work procedures and protective measures, use of protective clothing and respiratory protection, use of showers, entry and exit procedures from Work areas and in OSHA regulations. Each employee shall also understand the health implications and risks involved, including the illness possible from exposure to airborne asbestos fibers and the increased risk of lung cancer associated with smoking cigarettes and asbestos exposure, understand the use and limits of the respiratory equipment to be used, and understand the purpose of medical surveillance and the monitoring of airborne quantities of asbestos as related to health and respiratory equipment. The training program shall comply with federal, state and local regulatory requirements.

B. Emergency evacuation procedures to be followed in the event of Worker injury or shall be included in the worker training program.

3.2 DRESS AND EQUIPMENT

A. Work clothes shall consist of disposable full-body coveralls, head covers, boots, rubber gloves or equivalent. Sleeves at wrists and cuffs at ankles shall be secured. Fire retardant full-body coveralls are required in areas of open flame, or where required by local regulations.

B. Eye protection and hard hats shall be available as appropriate or as required by applicable safety regulations.

C. Provide authorized visitors with suitable protective clothing, headgear, eye protection, and footwear whenever they are required to enter the Work area.

3.3 RESPIRATORS

A. Respiratory protective equipment shall be MSHA/NIOSH approved in accordance with the provisions of 30 CFR Part 11. Respiratory instructions shall be posted in the clean room or work area.

B. Half-mask or full-face air-purifying respirators with HEPA filters may be worn during the preparation and work being performed.

C. The Contractor shall provide Workers with approved, permanently personally-issued and marked respirators with changeable filters. The Contractor shall provide a sufficient quantity of filters approved for Asbestos so that Workers can change filters during the workday. Filters shall not be used any longer than one (1) workday or whenever an increase in breathing resistance is detected. The respirator filters shall be stored at the job site in the Clean Room and shall be totally protected from exposure to asbestos before their use.

D. Workers shall always wear a respirator, properly fitted on the face, in the Work Area, from the start of preparation work until all areas have been given written clearance by the Observation Service.

3.4 WORKER PROTECTION PROCEDURES

Bilingual (English and other appropriate language) Worker protection procedures must be posted in the Clean Room or Work Area. If the first language of all Workers is English, the bilingual procedures are excepted.

A. Each Worker and Authorized Visitor shall, upon entering the job site: remove street clothes and put on a respirator and clean protective clothing before entering the Work Area.

B. All Workers shall, each time they leave the Work Area: remove gross contamination from clothing before leaving the Work Area; proceed to the Equipment Room and remove all clothing except respirators; still wearing the respirator, proceed naked to the showers; clean the outside of the respirator with soap and water while showering; remove the respirator; thoroughly shampoo and wash themselves.

C. Following showering and drying off, each Worker shall proceed directly to the Clean Room and dress in their personal clothing. Before reentering the Work Area, each Worker and Authorized Visitor shall put on a clean respirator and shall dress in clean protective clothing.

D. Contaminated protective clothing and work footwear shall be stored in the Equipment Room when not in use in the Work Area. At appropriate times or upon completion of Asbestos Abatement, dispose of protective clothing and footwear as contaminated waste, or launder in accordance with government regulations.

E. Workers removing waste containers from the Equipment Decontamination Enclosure shall enter the Holding Area from outside wearing a respirator and dressed in clean disposable coveralls. No Worker shall use this system as a means to leave or enter the Washroom or the Work Area.

F. The disposable clothing worn outside the Work Area shall be of different color or markings from the disposable clothing worn inside the Work Area.

G. Workers shall not eat, drink, smoke, or chew gum or tobacco while in the Work Area. Workers and Authorized Visitors with beards or who are unshaven shall not enter the Work Area.

3.5 MEDICAL DOCUMENTS

A. Before exposure to airborne Asbestos, the Contractor will provide each employee providing labor or professional services at the Project site with a current comprehensive medical exam, including a history of respiratory and gastrointestinal diseases, meeting the general definition outlined in 29 CFR 1910.1001, 29 CFR 1910.134, 29 CFR 1926.1101 and California Administrative Code Title 8, CAC Section 5208, page 442.2.l sub-part 1. The contractor shall submit a current medical examination report. The medical report shall contain a statement from the examining physician that the employee can function normally wearing a respirator or that the safety or health of the employee or other employees will not be impaired by his use of a respirator. No employee will be allowed to enter the Work Area without having first provided the completed copy of their medical examination to COMPTON COMMUNITY COLLEGE DISTRICT‘s Representative and until the medical report has been approved by the Observation Service.

3.6 EMPLOYEE IDENTIFICATION

A. Each employee shall bring to the job at least two forms of identification, one of which has his/her photograph.

PART 4 - WORK EXECUTION - ASBESTOS ABATEMENT PROCEDURES

4.1 WORK AREA PREPARATION AND REMOVAL FOR ASBESTOS MATERIALS

A. Preparation procedures for the Work including the removal the asbestos-containing materials and associated debris. Removal of these materials or other friable asbestos-containing materials**,** unless specified otherwise, shall be executed inside a fully "Contained" Work area.

1. All surfaces and fixed objects including carpets in the Work areas shall be pre-cleaned using HEPA filtered vacuums and/or wet cleaning methods as appropriate. Methods that would raise dust, such as dry sweeping or vacuuming with equipment with non HEPA filters must not be used. Asbestos-containing materials must not be disturbed during the pre-cleaning phase.

2. Contractor shall isolate the Work area for the duration of the Work by sealing all openings including, but not limited to, HVAC ducts, diffusers and grilles, skylights, doorways, and windows, with six (6) mil polyethylene taped securely to a clean surface. Spray adhesive, used on finished surfaces, should be avoided where possible. Construct barriers that enclose or separate Work Areas with wood or metal framing members and sheathed with 3/8" min. plywood. Barriers shall form a seal at vertical walls and at the floor deck above and below.

3. HVAC systems shall be shut down. Contractor shall design the Work area preparation and engineering controls as specified and/or as required to prevent damage to and contamination of the affected HVAC system. Contractor shall remove HVA system filters, and pack them in protective six (6) mil polyethylene sheeting for proper disposal. The Contractor shall install new filters upon completion of all Work.

4. Contractor shall remove all movable objects including but not limited to carpets from the Work area. All fixed and movable objects requiring cleaning shall be washed with amended water or cleaned with a HEPA filtered vacuum.

5. Clean and cover fixed and movable objects that remains in the Work area with six (6) mil polyethylene sheeting taped securely in place.

6. The objects removed shall be stored in a location designated by COMPTON COMMUNITY COLLEGE DISTRICT, and in a manner that will prevent contamination or damage to the objects. Damaged and missing objects will be replaced by the Contractor at his own expense and to the satisfaction of COMPTON COMMUNITY COLLEGE DISTRICT.

7. Seal and protect all light fixtures, exit signs and other electrical items, etc., that will remain within the Work area, with six (6) mil polyethylene, taped securely. The polyethylene cover shall be kept away from heat- generating electrical devices where fire or damage to the device is possible. Light fixtures and all other electrical items shall be thoroughly cleaned before covering.

8. Install 2' x 2' plexiglass observation window(s) at strategic location(s) in the "Containment" barrier to allow observation of work from outside the Work Area.

9. Seal all wall, plumbing, duct and other cavities to prevent asbestos materials contamination "fallout" from falling into cavities during the Work.

10. The Contractor shall check regularly (at beginning, middle and end of each shift as a minimum) all polyethylene isolation and containment (protective) barriers for punctures, loose seals, contact with heat- generating devices, etc. Problem areas shall be repaired or mended immediately.

11. Maintain existing emergency exits from the building**.** Maintain a minimum of two (2) exits from Work Areas where possible. The first exit shall be the Worker the Decontamination Enclosure System. The second exit may be the Equipment Decontamination Enclosure System or a ripcord type, emergency only exit in the plastic containment at a door, window or other appropriate location. Exits, where possible, shall be on opposite ends of the Work Area. All exits shall be labeled in bright letters or signage. The second exit shall be labeled "Emergency Exit Only." Establish alternative exits satisfactory to fire officials where existing building or Work Area emergency exits are unavoidably blocked by activities of this project.

12. Provide and maintain appropriate fire extinguishers inside and outside the Work.

13. All electrical power must be shut down during the wet removal or encapsulation phase of the Work. Provide temporary power and lighting when necessary, and ensure safe installation of temporary power sources and equipment per applicable electrical code requirements including appropriate ground fault protection. Temporary light fixtures will be explosion proof. Provide and maintain auxiliary diesel generator equipment where existing facility power is insufficient. Locate generator or vent generator exhaust in a manner that will prevent carbon monoxide hazards to workers and the public. When power shutdown is required, the Contractor shall check for conditions where shutdown will pose a danger to the building or to the building's components. Contractor shall take all precautions necessary, including inspections and testing, to insure the safety of his employees and other building occupants from electrical hazards during the course of the Work. Existing fire, smoke detection and other life safety systems shall be kept in operation at all times, or, the Contractor shall install and maintain a temporary system or alternate acceptable to COMPTON COMMUNITY COLLEGE DISTRICT and local fire officials.

14. The Contractor shall install and maintain negative air pressure equipment during the abatement and decontamination phases of the Work until the clearance test has passed. A sufficient amount of air shall be exhausted by the unit(s) to create a pressure of -0.02 inches of water within the Work area with respect to the area outside the Work area. A backup negative air unit must be in place in the event that the initial unit fails. In the event of a power failure, the backup emergency unit must be self-

starting with a diesel generator back-up power. Locate the generator or vent generator exhaust in a manner that will prevent carbon monoxide hazards to workers and others in the building When more than one negative air pressure unit is required, emergency power back-up is required for at least half of all the units.

15. Install and maintain a manometer from the time abatement begins until the clearance test has passed in all Work areas. All ratings must be recorded in writing for the duration of the Work. Report the readings to the Observation Service at the start and end of each work shift.

16. Notify the Observation Service twenty-four hours in advance of when preparatory steps will be completed. Asbestos Abatement Work shall not commence until: all preparation requirements have been completed; all tools, equipment, and materials are on hand; all required submittals, notices and permits have been approved, and until the Observation Service authorizes that Work may commence.

17. Daily log: Maintain for the duration of the project from the first disturbance of asbestos-containing material, a sign-in/sign-out log. All persons performing work or visiting the site must print, sign, and date the logbook along with their company name showing duration at work site.

B. Removal procedures for "Contained" Work:

1. Remove all visible accumulations of asbestos material and debris. Wet-clean all surfaces within the Work area to remove asbestos residue.

2. Upon completion of the cleaning, the Contractor shall perform a complete visual inspection of the Work area to ensure that the Work area is free of any visible debris or residue.

3. Upon completion of the visual inspection, the Contractor shall notify the Observation Service in advance that the Work area is ready for an inspection.

4. Upon proper notification, the Observation Service will inspect the Work area for general conformance with the Specifications. Any nonconformance of the Work shall be remedied by the Contractor until the Work area is in compliance, and at the Contractor's expense.

5. Once the inspection is performed and the Work is approved by the Observation Service, the Contractor shall encapsulate the surfaces where asbestos materials have been removed. All surfaces within ceiling and other accessible cavities where spray-applied or trowel-applied materials have been removed shall also be encapsulated. The encapsulant shall

be compatible with the existing substrate and replacement materials and shall be rated to safely withstand the temperature of the items to which it will be applied.

6. Upon completion of the encapsulation work, the Contractor shall notify the Observation Service in advance that the encapsulated surfaces are ready for inspection.

7. Upon proper notification, the Observation Service will inspect the encapsulated surfaces for general conformance with the Specifications. Any nonconformance of the Work shall be remedied by the Contractor until the Work is in compliance and at the Contractor's expense.

8. Upon successful compliance with the encapsulation inspection by the Observation Service, the Contractor shall remove the outer layer of plastic on the walls, floors, and ceilings (where applicable). The inner plastic layer and isolation barriers on vents, grilles, diffusers, etc., shall remain in place.

9. The Contractor shall repeat the necessary steps to remedy and correct the decontamination and encapsulation procedures in the event that the Contractor does not pass the inspection as conducted by the Observation Service. Remedial work shall be conducted by the Contractor at the Contractor's expense.

10. Wet-clean the Work area, wait twenty-four hours to allow for the settlement of dust, and again wet-clean, or clean with HEPA vacuum equipment, all surfaces within the Work area. After completing the second cleaning operation the Contractor shall perform a complete visual inspection of the Work Area to ensure that the Work Area is free of contamination.

11. Sealed drums and bags, and all equipment used in the Work area, shall be included in the cleanup and shall be removed from the Work area via the equipment decontamination enclosure system, at the appropriate time in the cleaning sequence.

12. Upon completion of the second cleaning operation, the Contractor shall notify the Observation Service twenty-four hours in advance that the Work area is ready for final inspection and air clearance testing. Contamination found during the final inspection shall be remedied by the Contractor at his expense.

13. Upon notification from the Observation Service that the Work area has passed the clearance testing, the Contractor shall proceed, where applicable in the Contract, the application of asbestos-free replacement

materials and re-establish objects and systems as specified in these specifications. The inner plastic layer and isolation barriers may be removed by the Contractor at any time after the Work Area inspection has passed the clearance testing.

14. Upon completion of the application of replacement materials (where applicable), or after the removal of the inner plastic layer, isolation barriers and the re-establishment of objects and systems, the Contractor shall notify the Observation Service twenty-four hours in advance that the Work area is ready for Review.

15. Upon notification, the Observation Service and COMPTON COMMUNITY COLLEGE DISTRICT's Representative will review the Work area. Improper application of replacement materials, unapproved damage to the facility or its contents, or improper re-establishment of objects and systems discovered during the review shall be itemized on a punch list for correction by the Contractor at his expense. If no deficiencies are discovered the Contract or this portion of the Contract shall be approved in writing by the Observation Service and COMPTON COMMUNITY COLLEGE DISTRICT's Representative as complete. If deficiencies are noted, continue with the subsequent procedures.

16. Upon correction of the punch list deficiencies the Contractor shall notify the Observation Service and COMPTON COMMUNITY COLLEGE DISTRICT 's Representative in advance that the Work area is ready for final review.

Upon notification, the Observation Service and COMPTON COMMUNITY COLLEGE DISTRICT's Representative will review the corrected Punch List deficiencies. If deficiencies have not been properly corrected, the Contractor shall repeat, at his expense, the above mentioned procedures until all deficiencies have been corrected and approved.

4.2 DECONTAMINATION ENCLOSURE SYSTEMS

A. Decontamination enclosure system for asbestos abatement work in "Contained" Work areas:

1. Construct a decontamination enclosure system for the Work area consisting of three separate enclosed chambers as follows:

a. Equipment chamber with an air lock to the Work area and a curtained doorway to the shower room.

b. Shower chamber with two curtained doorways, one to the equipment chamber and one to the clean chamber. The shower chamber shall

contain one shower with hot and cold or warm water. Careful attention shall be paid to the shower enclosure to ensure against air and water leaks. Trap shower waste using filters having a maximum pore size of 1.0 micron, and drain into a sanitary sewer. Replace filters when they become clogged. Ensure a supply of soap and disposable towels at all times in the shower chamber.

c. Clean chamber with one curtained doorway into the shower and one entrance or exit to non-contaminated areas of the building. The clean chamber shall have sufficient space for storage of the worker's street clothes, towels, and other non-contaminated items.

2. Construct an equipment decontamination enclosure system consisting of two totally enclosed chambers as follows:

a. Washroom with an air lock to a designated staging area of the Work Area and a curtained doorway to the holding chamber.

b. Holding chamber with a curtained doorway to the washroom and a doorway to an uncontaminated area.

4.3 DISPOSAL

A. Waste Transportation: Submit the method of transport of hazardous and non-hazardous waste including name, address, EPA I.D. number and telephone number of transporter.

B. Waste Site: Submit for approval the name, class, address, EPA I.D. number and telephone number of hazardous waste site(s) to be utilized for disposal.

C. Waste Manifest: Submit for approval at the Pre-Construction meeting a filled out Waste Manifest form. For Waste Manifest purposes the Generator is the facility of the subject work. Obtain necessary information for this purpose from COMPTON COMMUNITY COLLEGE DISTRICT. Give a copy of the Waste Manifest to Observation Service for each required shipment.

D. Containers to be loaded for transportation from the Holding Area must be removed by Workers who have entered from uncontaminated areas, dressed in clean overalls. Workers must not enter from the Holding Area into the Washroom or the Work Area.

1. The sealed asbestos containers shall be delivered to Contractor's pre designated approved non-hazardous waste site for burial; in accordance with local Air Pollution Control District Regulations.

E. Notify COMPTON COMMUNITY COLLEGE DISTRICT 48 hours in advance of the time when asbestos materials are to be removed from the site.

F. Contractor shall be responsible for safe handling and transportation of waste generated by this Contract to the designated waste site.

G. Contractor shall hold COMPTON COMMUNITY COLLEGE DISTRICT harmless for claims, damages, losses, and expenses against COMPTON COMMUNITY COLLEGE DISTRICT, including attorney's fees arising out of or resulting from asbestos spills on the site or spills on route to the disposal site.

4.4 ASBESTOS WHICH REMAINS

A. For asbestos-containing materials which cannot be removed as originally specified in these Contract Documents:

1. Apply a mist of encapsulating sealer into concealed areas with an airless sprayer, set at low pressure, to obtain absorption, good coverage, and penetration.

2. Contractor shall follow safety precautions required by manufacturer when handling sealer.

4.5 AIR MONITORING AND TESTING

A. Area Air Monitoring:

1. Throughout the removal and cleaning operations, area air monitoring shall be conducted by the Observation Service to ensure that the Contractor's work practices are minimizing worker and public exposures to airborne asbestos fibers in accordance with applicable codes, regulations, and ordinances. Fiber counting shall be done by the PCM Method No. 7400 established by NIOSH, with the following as minimum samples recommended by the EPA:

Areas To Be Sampled	Minimum No of Samples	Minimum Volume
Benchmark	1/work area	1300L
Work Area	1/work shift	1300L
Adjacent to Work Area	1/work shift	1300L
At Negative Air Equipment Exhaust	1/work shift	1300L

2. The Observation Service shall report the area air monitoring results to the Contractor on the following day. If area air monitoring results are exceed

the required threshold, the Contractor shall make changes in their work practices to assure compliance with the following standards. Unsatisfactory results are fiber counts within the Work area in excess of the maximum acceptable level (0.1 fibers/cc) or fiber counts outside the Work area in excess of the benchmark.

B. Contractor Personal Air Monitoring:

1. The Contractor shall perform periodic personnel air monitoring at their own cost. Initial and periodic eight (8) hour TWA and thirty (30) minute excursion limit air monitoring of Worker exposures to airborne concentrations of asbestos fibers shall be in accordance with OSHA - CFR 1926.1101 requirements.

2. The Contractor shall report personal monitoring results to the Observation Service within 24 hours from the end of each work shift. Worker exposures to airborne asbestos concentrations shall not exceed the permissible exposure limit (PEL) of 8-hour time-weighted average (TWA) of 0.1 fibers per cubic centimeter of air, or the 1f/cc 30-minute period excursion limit.

C. Clearance Testing:

1. Contained Work Areas: The Contractor will not be released until final inspection and air testing are performed according to Transmission Electron Microscopy (TEM) Methods (dependent on the quantity of ACM removed in each containment) in accordance with the guidelines set forth in the Environmental Protection Agency's 40 CFR Part 763 Appendix A to subpart E.

2. If the air tests show that the Work area has not been decontaminated, the Contractor must repeat the cleaning and/or encapsulation application until the Work area is cleaned to the satisfaction of the Observation Service.

The contractor will be released only after final air clearance according to the AHERA air clearance criteria has been achieved.

4.6 REIMBURSEMENT OF COSTS OF COMPTON COMMUNITY COLLEGE DISTRICT OR THE OBSERVATION SERVICE

A. In the event that inspections and/or air testing by the Observation Service or regulatory agencies shows that the Work area or any portion of the Work area is not decontaminated or if the Work is not in conformance with the Contract Documents, COMPTON COMMUNITY COLLEGE DISTRICT and the Observation Service will record all time, tests and project related expenses spent to monitor the Work until the work is in compliance. All time, and expenses recorded by COMPTON COMMUNITY COLLEGE DISTRICT and the Observation Service to monitor the above work, and

all time, tests and project related expenses incurred by COMPTON COMMUNITY COLLEGE DISTRICT and the Observation Service beyond the contract time shall, at the discretion of COMPTON COMMUNITY COLLEGE DISTRICT, be paid for by the Contractor. The Contractor, promptly upon receipt of the invoice from COMPTON COMMUNITY COLLEGE DISTRICT, or the Observation Service, shall reimburse COMPTON COMMUNITY COLLEGE DISTRICT at the normal billing rate of COMPTON COMMUNITY COLLEGE DISTRICT or the Observation Service or the COMPTON COMMUNITY COLLEGE DISTRICT is authorized to withhold funds from the Contract for all time spent by the COMPTON COMMUNITY COLLEGE DISTRICT and the Observation Service.

4.7 STOPPING THE WORK

A. If, at any time, the Observation Service decides that work practices are violating pertinent regulations, these contract documents or, in their opinion, endangering workers or the public, the Observation Service will immediately notify the Contractor that operations shall cease until corrective action is taken, and the Contractor shall take such corrective action before proceeding with the Work.

Cost for losses or damages due to a stop of the work shall be borne by the Contractor.

4.8 REPAIR AND PAINTING

A. N/A

4.9 CLEANUP

A. Contractor shall maintain a clean Project site during and upon completion of the Work. Cleaning shall be in accordance with these contract documents.

PART 5 - DEFINITIONS AND STANDARDS (General Industry Definitions)

- Abatement: Procedures to control fiber release from asbestos-containing building materials. Includes removal, encapsulation, and enclosure, repair, demolition and renovation activities.

- Air Lock**:** A system for permitting ingress and egress with minimum air movement between a contaminated area and an uncontaminated area. (See decontamination enclosure system plan in the drawing section of this Contract Document).

- Air Monitoring: The process of measuring the fiber content of a specific volume of air in a stated period of time.

- Air Sampling Professional**:** The professional contracted or employed to supervise air monitoring and analysis schemes. This individual is also responsible for recognition of technical deficiencies in Worker protection equipment and procedures during both planning and on-site phases of an abatement project. Acceptable Air Sampling Professionals include Industrial Hygienists,

Environmental Engineers and Environmental Scientists with equivalent experience in asbestos air monitoring and worker protection.

- Amended Water: Water to which a surfactant has been added.

- Area Monitoring: Sampling of airborne fiber concentrations within the asbestos work area and outside the asbestos work area which are representative of the airborne concentrations of asbestos fibers which may reach the breathing zone.

- Asbestos: Means fibrous forms of various hydrated minerals including Chrysotile, (fibrous serpentine), Crocidolite (fibrous Riebeckite), Amosite (fibrous Cummintonite-Grunerite), Fibrous Tremolite, fibrous Actinolite, and fibrous Anthophyllite.

- Asbestos-Containing Material (ACM) Material composed of asbestos of any type in an amount greater than 1 percent and by weight, either alone or mixed with other fibrous or non-fibrous materials.

- Asbestos-Containing Construction Material (California definition): Means any manufactured construction material which contains more than 1/10th of 1% asbestos by weight.

- Asbestos Fibers: Asbestos fibers having an aspect ratio of at least 3:1 and 5 micrometers in length.

- Authorized Visitor: COMPTON COMMUNITY COLLEGE DISTRICT's Project Team members, COMPTON COMMUNITY COLLEGE DISTRICT's Representative, Observation Service and any representative of a regulatory or other agency having jurisdiction over the Work.

- Clean Room: An uncontaminated area or room which is a part of the worker decontamination enclosure with provisions for storage of workers' street clothes and protective equipment.

- Contained Work Area: A Work Area which has been Isolated, Plasticized, and equipped with a Decontamination Enclosure System.

- Curtained Doorway: A device to allow ingress or egress from one area to another while permitting minimal air movement between the areas, typically constructed by placing three overlapping sheets of plastic over an existing or temporarily framed doorway, securing each along the top of the doorway, and securing the vertical edge of the outer two sheets along the opposite vertical side of the doorway (see detail on Decontamination Enclosure System Plan in the Drawing section of this Project Manual.)

- Decontamination Enclosure System: A series of connected rooms, with Air Locks or Curtained Doorways between any two adjacent rooms, for the decontamination of Workers and of materials and equipment. A Decontamination Enclosure System always contains at least one Air Lock to the Work Area (see

standard Decontamination Enclosure System Plan in the Drawing section of this Project Manual.)

- Encapsulant (sealant): A liquid material which can be applied to Asbestos-Containing material and which controls the possible release of Asbestos fibers from the material either by creating a membrane over the surface (bridging encapsulant) or by penetrating into the material and binding its components together (penetrating encapsulant).

- Encapsulation: All herein-specified procedures necessary to apply an encapsulant to Asbestos-Containing building materials to control the possible release of Asbestos fibers into the ambient air.

- Enclosure: All herein-specified procedures necessary to enclose completely Asbestos-Containing Material behind airtight, impermeable, permanent barriers.

- Excursion Limit: An exposure of airborne concentrations of Asbestos fibers of one fiber per cubic centimeter of air (1f/cc) as averaged over a sampling period of thirty (30) minutes.

- Equipment Room: A contaminated area or room which is part of the Worker Decontamination Enclosure with provisions for storage of contaminated clothing and equipment.

- Equipment Decontamination Enclosure: That portion of a Decontamination Enclosure System designed for controlled transfer of materials, waste containers and equipment, typically consisting of a Washroom and a Holding Area.

- Friable Asbestos Material (40 CFR, sub-part M Definition): Material that contains more than one percent (1%) asbestos by weight and that can be broken, crumbled, pulverized, or reduced to powder by hand pressure when dry.

- Fixed Object: A unit of equipment or furniture or other building component which cannot be detached from the building or can only be detached by destructive methods resulting in irreparable damage to the item.

- Glove bag Method: A method with limited applications for removing small amounts of friable Asbestos-Containing material from HVAC ducts, short piping runs, valves, joints, elbows, and other non-planar surfaces in an Isolated (non-contaminated) Work Area. The glove bag (typically constructed of six [6] mil transparent WT plastic) has two inward-projecting long sleeve rubber gloves, one inward-projecting WT sleeve, an internal tool pouch, and an attached, labeled receptacle for Asbestos waste. The glove bag is constructed and installed in such a manner that it surrounds the object or area to be decontaminated and contains all Asbestos fibers released during the removal process. All Workers who are permitted to use the Glove bag Method must be highly trained, experienced, and skilled in this method.

- HEPA Filter: A high efficiency particulate air (HEPA) filter capable of trapping and retaining 99.97 percent of all mono-dispersed particles (Asbestos fibers) equal to or greater than 0.3 microns in mass median aerodynamic equivalent diameter.

- HEPA Vacuum Equipment: Vacuuming equipment with a HEPA filter system.

- Holding Area: A room in the Equipment Decontamination Enclosure located between the Washroom and an uncontaminated area. The Holding Area comprises an Air Lock.

- Isolation: The sealing of all openings into a Work Area.

- Isolated (non-contained) Work Area: A Work Area which is Isolated, but has not been Plasticized and may or may not be equipped with a Decontamination Enclosure System.

- Movable Object: A unit of equipment, furniture or other building component which is detached or can be detached from the building without destructive methods or results.

- Negative Air Pressure Equipment: A portable local exhaust system equipped with HEPA filtration and capable of maintaining a constant, low velocity air flow into contaminated areas from adjacent uncontaminated areas.

- Non-friable Asbestos-Containing Material: Material that contains more than one (1) percent Asbestos by weight in which the fibers have been locked in by a bonding agent, coating, binder, or other material so that the Asbestos is well bound and will not release fibers during any appropriate end-use, handling, demolition, storage, transportation, processing, or disposal.

- Observation Service: The agent of COMPTON COMMUNITY COLLEGE DISTRICT or COMPTON COMMUNITY COLLEGE DISTRICT's Representative who shall observe the Work, perform tests, verify that abatement methods and procedures specified by the Contract Documents are being complied with, and reports all observations and test results to COMPTON COMMUNITY COLLEGE DISTRICT or COMPTON COMMUNITY COLLEGE DISTRICT's Representative.

- Owner: COMPTON COMMUNITY COLLEGE DISTRICT.

- Permissible Exposure Limit (PEL): An airborne concentration of asbestos, Tremolite, Anthophyllite, Actinolite, or a combination of these minerals in excess of 0.1 fibers per cubic centimeter of air as an eight (8) hour time-weighted average (TWA), as determined by OSHA 29 CFR standards 1926.1101.

- Personal Monitoring: Sampling of Asbestos fiber concentrations within the breathing zone of an Asbestos Worker.

- Plasticize: To cover floors, walls and other structural elements of a Work Area with plastic sheeting as herein specified with all seams securely taped.

- Removal: All herein-specified procedures necessary to remove Asbestos-Containing materials from the designated areas and to dispose of these materials at an acceptable site.

- Shower Room: A room between the Clean Room and the Equipment Room in the Worker Decontamination Enclosure with hot and cold or warm running water, and suitably arranged for complete showering during decontamination. The Shower Room comprises an Air Lock between contaminated and clean areas.

- Surfactant: A chemical wetting agent added to water to reduce surface tension and improve penetration.

- Washroom: A room between the Work Area and the Holding Area in the Equipment Decontamination Enclosure System where equipment and waste containers are decontaminated. The Washroom comprises an Air Lock.

- Wet Cleaning: The process of eliminating Asbestos contamination from building surfaces and objects by using cloths, mops, or other cleaning tools which have been dampened with water, and by afterwards disposing of these cleaning tools as Asbestos-contaminated waste.

- Work Area (Also known as "Regulated Area"): Designated rooms, spaces, or areas of the Project in which Asbestos Abatement actions are to be undertaken or which may become contaminated as a result of such abatement actions. A Contained Work Area is a Work Area which has been Isolated, Plasticized, and equipped with a Decontamination Enclosure System. An Isolated (non- contaminated) Work Area is a Work Area which is Isolated, but has not been Plasticized and may or may not be equipped with a Decontamination Enclosure System.

- Worker Decontamination Enclosure System: That portion of a Decontamination Enclosure System designed for controlled passage of Workers, and other personnel and Authorized Visitors, typically consisting of a Clean Room, a Shower Room, and an Equipment Room.

END OF SECTION

This page intentionally left blank.

LEAD-BASED PAINT PROJECT SPECIFICATIONS

For:

EL CAMINO COLLEGE CENTER
BUILDINGS E, F, G, M1 AND M2
1111 EAST ARTESIA BOULEVARD
COMPTON, CALIFORNIA 90221

PRESENTED TO:

Compton Community College District
1111 East Artesia Boulevard
Compton, California 90221

PRESENTED BY:

BAINBRIDGE
Environmental Consultants

1322 Bell Avenue, Suite 1N
Tustin, CA 92780
Phone: 714-247-0024
Fax: 714-247-0025

Bainbridge Project # 17015811.20
January 22, 2017

SECTION 02090 – LEAD ABATEMENT

PART 1 – GENERAL

The work required to be performed by the Contractor comprises the following:

Project Title: El Camino College Center – Buildings E, F, G, M1 and M2
Client: Compton Community College District
Location: 1111 East Artesia Boulevard, Compton, California 90221

1.1 WORK DESCRIPTION

The work included consists of furnishing labor, materials, permits, equipment, services, insurance including but not limited to the handling and transportation and disposal of lead- containing materials and waste resulting from the removal of lead-containing materials in various areas. This work shall be conducted by a licensed abatement contractor and certified personnel in accordance with all applicable Federal, State, and local regulations.

A. Materials and their quantities to be abated shall be verified by the General Contractor/Abatement Contractor prior to the abatement work. Abatement work shall be cross-referenced and shall be coordinated with Compton Community College District. Refer to Bainbridge's Comprehensive Asbestos and Lead-Based Paint Survey Report for El Camino College Center – Buildings E, F, G, M1 and M2 dated January 22, 2017 for a full and complete description of the materials and locations surveyed. The lead-containing materials to be abated and their general location(s) and estimated quantities are as follows:

BUILDING E:
Lead-based Paint

XLNo	Side	Building	Room	Source	Substrate	Color	Results mg/cm^2	Positive Negative	Approx. Quantity
7	A	E	Exterior	Window Casing	Metal	Blue	1.3	POSITVE	6,000 Lin. Ft.
8	A	E	Exterior	Window Mullion	Wood	Blue	1.9	POSITVE	See Above
19	C	E	Exterior	Window Casing	Metal	Blue	1.0	POSITVE	See Above
20	C	E	Exterior	Window Sash	Metal	Blue	1.0	POSITVE	See Above

BUILDING E:
Lead-based Paint

XLNo	Side	Building	Room	Source	Substrate	Color	Result mg/cm^2	Positive Negative	Approx. Quantity
30	B	E	E-31	Interior West Wall	Wood	White	1.1	POSITVE	1,000 Sq. Ft.
31	C	E	E-31	Interior North Wall	Wood	White	1.7	POSITVE	See Above
43	D	E	E-31	Office Interior East Wall	Wood	White	1.1	POSITVE	See Above
44	C	E	E-31	Office Window Frame	Metal	Blue	1.0	POSITVE	See Sample No. 7
73	X	E	E-36	Sink	Porcelain	White	6.0	POSITVE	15 Sinks
74	X	E	E-36	Toilet	Porcelain	White	8.0	POSITVE	20 Toilets
101	A	E	Exterior	Eaves	Wood	White	1.6	POSITVE	2,600 Sq. Ft,
111	A	E	Exterior	Eaves	Wood	White	3.1	POSITVE	See Above

BUILDING F:
Lead-based Paint

XLNo	Side	Building	Room	Source	Substrate	Color	Results mg/cm^2	Positive Negative	Approx. Quantity
135	A	F	Exterior	Support Column	Metal	Blue	0.7	POSITIVE	900 Sq. Ft.
140	A	F	Exterior	Eaves	Wood	White	0.9	POSITIVE	4,000 Sq. Ft.
145	C	F	Women's Restroom	Window Sash	Metal	White	3.0	POSITIVE	5,500 Sq. Ft.

BUILDING F:
Lead-based Paint

XLNo	Side	Building	Room	Source	Substrate	Color	Results mg/cm²	Positive Negative	Approx. Quantity
150	B	F	F-41	Interior West Wall	Wood	White	1.1	POSITIVE	1,000 Sq. Ft.
157	D	F	F-39	Sink	Porcelain	White	40.9	POSITIVE	15 Sinks
165	D	F	F-32	Sink	Porcelain	White	7.3	POSITIVE	See Above
167	A	F	Staff Men's Restroom	Sink	Porcelain	White	4.2	POSITIVE	See Above
168	A	F	Staff Men's Restroom	Toilet	Porcelain	White	10.1	POSITIVE	20 Toilets
278	D	F	Portico East Side	Support Column	Metal	Blue	1.6	POSITIVE	See XL No. 135

BUILDING G:
Lead-based Paint

XLNo	Side	Building	Room	Source	Substrate	Color	Results mg/cm²	Positive Negative	Approx. Quantity
215	A	G	Exterior	Crawl Space Door Overhang	Metal	White	0.9	POSITIVE	25 Sq. Ft.
218	B	G	Exterior	Louver	Metal	White	1.4	POSITIVE	50 Sq. Ft.
221	A	G	Exterior	Louvers	Metal	White	1.1	POSITIVE	See Above
230	C	G	Women's Restroom	Window Casing	Metal	White	1.9	POSITIVE	3,000 Lin. Ft.
231	C	G	Women's Restroom	Window Sash	Metal	White	2.5	POSITIVE	See Above

In the event that other materials are found to be similar or homogenous to the materials sampled, and determined to contain lead-based paint, those similar or homogenous materials will be considered assumed lead-based paint containing materials. Prior to bid, contractor is responsible for field verification of all identified and/or assumed lead-based paint materials, their quantities and measurements.

A. Currently, the State of California, the U.S Department of Housing and Urban Development (HUD), and the Environmental Protection Agency (EPA) define lead-based paint as paint or other surface coating with lead content equal to

or greater than 1.0 milligram per square centimeter (mg/cm^2), 0.5% by weight and/or 5,000 parts per million lead on the surface area. However, The County of Los Angeles Department of Health Services (DHS) defines Lead-Based Paint as any paint or surface coating with concentrations of lead at or above 0.7 milligram per square centimeter (mg/cm^2). Based on the location of the subject property in Los Angeles County the "abatement level" (threshold) setting of 0.7 mg/cm^2 will be used for this project.

B. Lead abatement observation services shall be conducted by a third party consultant and shall be contracted directly by COMPTON COMMUNITY COLLEGE DISTRICT

1.2 REFERENCES

A. The references listed are made a part of this specification to the extent referenced.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z9.2	1979 Fundamentals Governing the Design and Operation of Local Exhaust Systems
ANSI Z88.2	1980 Respiratory Protection

HUD GUIDELINES Guidelines for the Evaluation and Control of Lead containing materials Hazards in Housing 1995

Title X	(Residential Lead containing materials Hazard Reduction Act of 1992) of Housing and Community Development Act of 1992

CALIFORNIA CODE OF REGULATIONS (CCR)

8 CCR	Section 1532.1 – Lead in Construction Standard
17 CCR	Division 1, Chapter 8 – Accreditation, Certification and Work Practices for Lead Based- Paint and Lead Hazards
22 CCR	California Code of Regulations – Hazardous Waste Requirements

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910	General Industry Standards
29 CFR 1910.1025	Lead Standard for General Industry
29 CFR 1910.134	Respiratory Protection
29 CFR 1910.1200	Hazard Communication
29 CFR 1910.245	Specifications for Accident Prevention (Sign and Tags)
29 CFR 1926	Construction Industry Standards

29 CFR 1926.55	Gases, Vapors, Fumes, Dusts, and Mists
29 CFR 1926.57	Ventilation
29 CFR 1926.62	Construction Industry Lead Standard
36 CFR 68	The Secretary of the Interior's Standards for the Treatment of Historic Properties. Washington, DC: US Department of the Interior, National Park Service, 1992.
40 CFR 260	Hazardous Waste Management Systems: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Generators of Hazardous Waste
40 CFR 263	Transporters of Hazardous Waste
40 CFR 264	States and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status and Standards for States and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 172	Hazardous Materials Tables and Hazardous Materials Communications Regulations
40 CFR 178	Shipping Container Specification

UNDERWRITERS LABORATORIES INC. (UL)

UL 586	1990 High-Efficiency, Particulate, Air Filter Units

1.3 CODES AND REGULATIONS

A. In addition to the requirements of this specification, comply with the following:

1.4.1 Clean Air Act (CAA) 40 CFR 52.

1.4.2 South Coast Air Quality Management District's (SCAQMD) Rule 1420.

1.5 GENERAL DESCRIPTION

The work includes the removal of lead hazards and coatings from surfaces scheduled to be impacted by the rehabilitation and demolition activities. Abate all lead containing materials hazards in accordance with these specifications and in accordance with all applicable regulations as noted herein. Additionally, the contractor will dispose of all debris.

1.6 QUALITY ASSURANCE

1.6.1 Medical Examinations

Before exposure to lead-contaminated dust, provide workers with a comprehensive medical examination as required by 8 CCR 1532.1, 29 CFR 1910.1025 and 29 CFR 1910.1200. The examination will not be required if adequate records show that employees have been examined as required by 8 CCR 1532.1, and 29 CFR 1910.1025 within the last year.

1.6.2 Medical Records

Maintain completed and accurate medical records of employees for a period of at least 40 years or for the duration of employment plus 20 years, whichever is longer.

1.6.3 Personnel Training

Train each employee performing paint removal and disposal in accordance with 17 CCR Div. 1 Chapter 8, 8 CCR 1532.1, and 29 CFR 1910.1025. Provide certificates for employee stating that the employee has received training.

1.6.4 Respiratory Protection Program

A. Furnish each employee required to wear a negative pressure respirator or other appropriate type with a respirator fit at the time of initial fitting and at least every 6 months thereafter as required by 8 CCR 1532.1 and 29 CFR 1910.1025.
B. Establish and implement a respiratory protection program as required by ANSI Z88.2, 29 CFR 1910.134, 29 CFR 1910.1025 and 29 CFR 1926.55.

1.6.5 Hazard Communication Program

Establish and implement a Hazard Communication Program as required by 29 CFR 1910.1200.

1.6.6 Hazardous Waste Management

The Hazard Waste Management plan shall comply with applicable requirements of federal, state, and local hazardous waste regulations and shall address:

A. Identification of hazardous wastes associated with the work.

B. Estimated quantities of wastes to be generated and disposed of.

C. Names and qualifications of the contractor transporting, storing, treating, and disposing of the waste. Include the facility location and a 24-hour point of contact with name, address and telephone number. Identify what EPA, state and local hazardous waste permits are required to authorize/permit the transport, storage treatment and/or disposal of the hazardous materials and provide proof that the

Contractor has obtained the required permits. Include EPA identification number, with expiration date.

D. Names and qualifications (experience and training) of personnel who will be working on-site with hazardous wastes.

E. Spill prevention, containment, and cleanup contingency measures to be implemented.

F. Work plan and schedule for waste containment, removal and disposal. Waste shall be cleaned up and containerized daily.

1.6.7 Ambient Air Monitoring

Periodic ambient air monitoring shall be conducted using air-sampling equipment set between and downwind of the work area.

1.7 SUBMITTALS

Submit all required documents for the identification and confirmation for training, lead-paint medical examinations and the respiratory protection program of workers for this contract per the requirements by COMPTON COMMUNITY COLLEGE DISTRICT.

Also, submit the following:

1.7.1 Manufacturer's Catalog Data

A. Vacuum Filters

B. Respirators

C. Instructions

1.7.2 Lead Containing Material Removal Plan

The Contractor must submit a detailed job-specific plan of the work procedures to be used in the removal of lead containing materials and lead hazards. The plan shall include a sketch showing the location, size, and details of lead control areas, location and details of decontamination rooms, change rooms, shower facilities, and mechanical ventilation system. Include in the plan, eating, drinking, smoking and restroom procedures, interface of trades, sequencing of lead related work, collected wastewater and paint debris disposal plan, air sampling plan, respirators, protective equipment, and a detailed description of the method of containment of the operation to ensure that airborne lead concentrations of 30 micrograms per cubic meter of air are not exceeded outside of the lead control area.

A. Notification - Submit form 8551 to The California Department of Health Services with a copy to COMPTON COMMUNITY COLLEGE DISTRICT's Representative within 5 working days prior to the start of any lead removal work, as required by 17 CCR Div. 1 Chapter 8.

B. Notify COMPTON COMMUNITY COLLEGE DISTRICT in writing 10 calendar days prior to the start of any lead removal work.

1.8 EQUIPMENT

1.8.1 Respirators

Furnish appropriate respirators approved by NIOSH, for use in atmospheres containing lead dust. Respirators shall comply with the requirements of 8 CCR 1532.1 and 29 CFR 1910.1025.

1.8.2 Special Protective Clothing

Furnish personnel who will be exposed to lead-contaminated dust with appropriate disposable protective whole body clothing, head covering, gloves, and foot coverings. Furnish appropriate disposable plastic or rubber gloves to protect hands.

1.8.3 Rental Equipment Notification

If rental equipment is to be used during lead containing material handling and disposal, notify the rental agency in writing concerning the intended use of the equipment. Furnish a copy of the written notification to COMPTON COMMUNITY COLLEGE DISTRICT.

PART 2 PRODUCTS

2.1 LEAD CONTAINING MATERIAL REMOVAL PRODUCTS

Submit applicable Material Safety Data Sheets for lead removal products used in removal work. Use the least toxic product acceptable to COMPTON COMMUNITY COLLEGE DISTRICT. Conform to 29 CFR 1926.57 for ventilation.

2.2 ENCAPSULATING SEALER (WHERE APPLICABLE)

Shall be a penetrating or bridging type, pollution-free sealer. Shall be L-B-C Lead Encapsulant brand or equal. Product shall have the lowest shell thickness for wall restoration work. Submit applicable Material Safety Data Sheets for seal coating. Use the least toxic product acceptable to COMPTON COMMUNITY COLLEGE DISTRICT. Conform to 29 CFR 1926.57 for ventilation.

PART 3 EXECUTION

3.1 PROTECTION

3.1.1 Lead Control Area Requirements

A. Establish a lead control area by completely enclosing the area or structure where lead-containing material removal operations will be performed.

B. Contain removal operations by the use of a negative pressure full containment system with at least one change room and with HEPA filtered exhaust.

C. Verify that personnel are not in building affected areas at the time of lead material removal.

3.1.2 Protection of Existing Work to Remain

Perform lead material removal work without damage or contamination of adjacent areas. Where existing work is damaged or contaminated, restore work to its original condition.

3.1.3 Boundary Requirements

Provide physical boundaries around the lead control area by demarcating the area designated in the Contractor's Lead Containing Material Removal Plan, providing curtains, portable partitions or other enclosures to ensure that airborne concentrations of lead will not reach 30 micrograms per cubic meter of air outside of the lead control area.

3.1.4 Heating, Ventilating and Air Conditioning (HVAC) Systems

Shut down, lock out, and isolate HVAC systems that supply, exhaust, or supply through the lead control area. Seal intake and exhaust vents in the lead control area with 6-mil plastic sheet and tape. Seal seams in HVAC components that pass through the lead control area.

3.1.5 Change Room and Shower Facilities

Provide clean change rooms and shower facilities within the physical boundary around the designated lead control area in accordance with requirements of 8 CCR 1532.1 and 29 CFR 1910.1025.

3.1.6 Mechanical Ventilation System

A. Use adequate ventilation to control personnel exposure to lead in accordance with 29 CFR 1926.57.

B. To the extent feasible, use fixed local exhaust ventilation connected to HEPA filters. Local exhaust ventilation systems shall be designed, constructed, installed, and maintained in accordance with ANSI Z9.2.

3.1.7 Personnel Protection

Personnel shall wear and use protective clothing and equipment as specified herein. Eating, smoking, or drinking is not permitted in the lead control area. No one will be permitted in the lead control area unless they have appropriate training and protective equipment.

3.1.8 Warning Signs

Provide warning signs at approaches to lead control areas. Locate signs at such a distance that personnel may read the sign and take the necessary precautions before entering the area. Signs shall comply with the requirements of 8 CCR 1532.1 and 29 CFR 1910.1025. Signs shall be in both English and Spanish. Signs shall be at least 20" x 14" with bold lettering not smaller than 2" in size. Signs shall read as follows:

WARNING
LEAD REMOVAL HAZARD
UNAUTHORIZED ENTRY PROHIBITED
NO SMOKING, EATING OR DRINKING ALLOWED IN THE WORK AREA

3.2 WORK PROCEDURES

Perform removal of lead containing material in accordance with approved lead- containing material removal plan. Use procedures and equipment required to limit occupational and environmental exposure to lead when lead containing materials are removed in accordance with 29 CFR 1910.1025, except as specified herein. Dispose of removed materials and associated waste in compliance with Environmental Protection Agency (EPA), federal, state, and local requirements.

3.2.1 Monitoring

Monitoring of airborne concentrations of lead shall be in accordance with 8 CCR 1532.1 and 29 CFR 1910.1025 and as specified herein. Air monitoring, testing, and reporting shall be performed by a California Department of Health Services certified project monitor.

A. The project monitor shall be on the job site to provide inspections of the lead containing materials removal work to ensure that the requirements of the Contract have been satisfied during the entire lead containing materials removal operation.

B. Collect air samples and submit results of air monitoring samples within 48 hours after the air samples are collected. Notify COMPTON COMMUNITY COLLEGE

DISTRICT or COMPTON COMMUNITY COLLEGE DISTRICT's Representative immediately of exposure to lead at or in excess of the action level of 30 micrograms per cubic meter of air outside of the lead control area.

3.2.2 Monitoring During Lead Removal Work

Perform area monitoring during the lead containing material removal operation. Sufficient area monitoring shall be conducted at the physical boundary to ensure unprotected personnel are not exposed above 30 micrograms per cubic meter of air at all times. If the outside boundary lead levels are at or exceed 30 micrograms per cubic meter of air, work shall be stopped and the Project Monitor shall notify the contractor to immediately correct the condition(s) causing the increased levels and notify the School District immediately. The Project Monitor shall review the sampling data collected on that day to determine if condition(s) requires any further change in work methods. Removal work shall resume when approval is given by the Project Monitor. The Contractor shall control the lead level outside of the work boundary to less than 30 micrograms per cubic meter of air at all times. As a minimum, conduct area monitoring daily on each shift in which lead removal operations are performed in areas immediately adjacent to the lead control taken on the downwind side of the lead control area.

If adjacent areas are contaminated, clean, visually inspect and take wipe samples (if applicable) of the contaminated areas. The Project Monitor shall certify that the area has been cleaned of lead contamination.

3.2.3 Clearance Testing and Standards

At the completion of lead abatement, final cleaning and waste removal, the project monitor will collect the necessary clearance samples as required by the HUD Guidelines and/or 17 CCR Div. 1 Chapter 8.

3.3 LEAD PAINT CONTAINING MATERIAL REMOVAL

Lead removal shall be performed in accordance with the accepted Contractor's Lead Removal Plan as modified and approved by COMPTON COMMUNITY COLLEGE DISTRICT. The lead removal plan shall comply with all applicable regulations noted in this specification. The plan shall address the method and procedures for the removal and/or stabilization of lead paint containing materials.

3.3.1 Selection of Removal Process

Select paint removal processes to minimize contamination of work areas with lead-contaminated dust or other lead-contaminated debris/waste. The following paint removal is unacceptable:

A. Gas-fired open-flame burning.

B. Grinding or sanding.

C. Uncontained water blasting.

D. Open abrasive blasting.

3.3.2 Surface Preparation

Avoid flash rusting or other deterioration of the substrate. Provide surface preparations for painting in accordance with COMPTON COMMUNITY COLLEGE DISTRICT's requirements.

3.4 CLEANUP AND DISPOSAL

3.4.1 Cleanup

Maintain surfaces of the lead control area free of accumulations of debris and dust. Restrict the spread of dust and debris; keep waste from being distributed outside the work area. Do not dry sweep or use compressed air to clean up the area. At the end of each shift and when the paint removal operation has been completed, clean the area of visible lead paint contamination by vacuuming with a HEPA filtered vacuum cleaner.

3.4.2 Testing of Lead-Containing Paint Residue and Used Abrasive

A. Perform testing of lead-containing materials residue and used chemicals remover where indicated or when directed by COMPTON COMMUNITY COLLEGE DISTRICT, in accordance with 40 CFR 261 and TITLE 22 for hazardous waste.

3.4.3 Disposal

A third-party, independent consulting company (Bainbridge) will perform lead-waste characterization testing (TTLC/STLC) of abated lead-containing materials to determine Federal and State waste disposal requirements. Contingent upon waste characterization results; lead-containing waste disposal will be conducted as follows:

A. Collect lead-contaminated waste, scrap, debris, bags, containers, equipment, and lead-contaminated clothing, which may produce airborne concentrations of lead particles. Label the containers in accordance with 29 CFR 1910.1025. Dispose of lead-contaminated waste material at an EPA, CCR and California Administrative Code (CAC) TITLE 22 approved hazardous waste treatment, storage, or disposal facility.

B. Store waste materials in U.S. Department of Transportation (49 CFR 178) approved 55-gallon drums. Properly label each drum to identify the type of waste (49 CFR 172) and the date the drum was filled. COMPTON COMMUNITY COLLEGE DISTRICT or COMPTON COMMUNITY COLLEGE DISTRICT's Representative will assign an area for interim storage of waste-containing drums. Do not store hazardous waste drums in interim storage longer than 90 calendar days from the date affixed to each drum.

C. Handle, store, transport and dispose lead or lead-contaminated waste in accordance with 40 CFR 260 through 40 CFR 265. Comply with land disposal restriction and notification as required by 40 CFR 268.

3.4.4 Disposal Documentation

Submit written evidence that the hazardous waste treatment, storage, or disposal facility (TSD) is approved for lead disposal by the EPA and state or local regulatory agencies. Submit one copy of the completed manifest, signed and dated by the initial transporter in accordance with 40 CFR 262.

3.4.5 Payment for Hazardous Waste

Payment for disposal of hazardous waste will not be made until a signed copy of the manifest from the treatment or disposal facility certifying the amount of lead-containing materials delivered is returned and a copy is furnished to COMPTON COMMUNITY COLLEGE DISTRICT.

4.1 DEFINITIONS

A. Action Level for Airborne Lead Concentrations -- Employee exposure, without regard to use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air averaged over an 8-hour period. As used in this section, “30 micrograms per cubic meter of air” refers to the action level.

B. Area monitoring -- Sampling of lead concentrations within the lead control area and inside the physical boundaries of the work area.

C. Physical Boundary -- Area partitioned off around an enclosed lead control area to limit unauthorized entry of personnel.

D. Project Monitor -- As used in this section, refers to a California Department of Health Services certified project monitor employed by COMPTON COMMUNITY COLLEGE DISTRICT as a third party monitoring service personnel.

E. Change Rooms and Shower Facilities -- Rooms within the designated physical boundary around the lead control area equipped with separate storage facilities for clean protective work clothing and equipment and for street clothes which prevent cross-contamination.

F. Decontamination Room -- Room for removal of contaminated personal protective equipment and clothing.

G. Eight-Hour Time Weighted Average (TWA) -- Airborne concentration of lead averaged over an 8-hour workday to which an employee is exposed.

H. High Efficiency Particulate Air (HEPA) Filter Equipment -- HEPA filtered vacuuming equipment system capable of collecting and retaining lead- contaminated paint dust.

I. Lead -- Metallic lead, inorganic lead compounds. Excluded from this definition are other organic lead compounds.

J. Lead Control Area -- An enclosed area or structure with full containment to prevent the spread of lead dust, paint chips, or debris of lead containing pain removal operations. The lead control area is isolated by physical boundaries to prevent unauthorized entry of personnel.

K. Lead Permissible Exposure Limit (PEL) -- Fifty micrograms per cubic meter of air in an 8-hour time weighted average as determined by 8 CCR 1532.1 and 29 CFR 1910.1025.

L. Personal Monitoring -- Sampling of lead concentrations within the breathing zone of an employee to determine the 8-hour time weighted average concentration in accordance with 8 CCR 1532.1 and 29 CFR 1910.1025. Samples shall be representative of the employee's work tasks. Breathing zone shall be considered an area within a hemisphere, forward of the shoulder, with a radius of 6 to 9 inches and the center at the nose or mouth of an employee.

M. Hazard Abatement: Long-term measures to remove the hazards of lead-based paint through selective paint stripping of deteriorated areas; or, in some cases, replacement of deteriorated features.

N. Hazard Control: Measures to reduce lead hazards to make housing safe for young children. Can be accomplished with interim (short-term) or hazard abatement (long-term) controls.

O. Owner: COMPTON COMMUNITY COLLEGE DISTRICT.

END OF SECTION

This page intentionally left blank.

SECTION 024116 - STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of buildings and site improvements.
2. Removing below-grade construction.
3. Disconnecting, capping or sealing, and removing site utilities.
4. Salvaging items for reuse by Owner.

B. Related Requirements:

1. Section 011000 "Summary" for use of the premises and phasing requirements.
2. Section 013200 "Construction Progress Documentation" for preconstruction photographs taken before building demolition.
3. Section 024119 "Selective Demolition" for partial demolition of buildings, structures, and site improvements.
4. Section 028213 "Asbestos Abatement" for asbestos abatement.
5. Section 028319.13 "Lead-Based Paint Abatement" for lead-based paint abatement.
6. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade site improvements not part of building demolition.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse. Include fasteners or brackets needed for reattachment elsewhere.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be demolished.
2. Review structural load limitations of existing structures.
3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review and finalize protection requirements.
5. Review procedures for noise control and dust control.
6. Review procedures for protection of adjacent buildings.
7. Review items to be salvaged and returned to Owner.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control, and for noise control. Indicate proposed locations and construction of barriers.

1. Adjacent Buildings: Detail special measures proposed to protect adjacent buildings to remain including means of egress from those buildings.

C. Schedule of Building Demolition Activities: Indicate the following:

1. Detailed sequence of demolition work, with starting and ending dates for each activity.
2. Temporary interruption of utility services.
3. Shutoff and capping or re-routing of utility services.

D. Predemolition Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by salvage and demolition operations. Submit before the Work begins.

1. Comply with Section 013233 "Photographic Documentation."

E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.7 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.8 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Universal certified by EPA-approved certification program.

1.9 FIELD CONDITIONS

A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.

B. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.

1. Provide not less than 72 hours notice of activities that will affect operations of adjacent occupied buildings.
2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.

a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.

C. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

1. Before building demolition, Owner will remove the following items:

a. Furniture, fixtures, and equipment.

D. Hazardous Materials: Present in buildings D, E, and F and structures to be demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

1. Hazardous material remediation is specified elsewhere in the Contract Documents.
2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
3. Owner will provide material safety data sheets for materials that are known to be present in buildings and structures to be demolished because of building operations or processes performed there.

E. On-site storage or sale of removed items or materials is not permitted.

1.10 COORDINATION

A. Arrange demolition schedule so as not to interfere with Owner's on-site operations and operations of adjacent occupied buildings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

2.2 SOIL MATERIALS

A. Satisfactory Soils: Comply with requirements in Section 312000 "Earthwork."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.

1. Perform surveys as the Work progresses to detect hazards resulting from demolition activities.

D. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.

E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

F. Inventory and record the condition of items to be removed and salvaged.

3.2 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

B. Salvaged Items: Comply with the following:

1. Clean salvaged items of dirt and demolition debris.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to storage area designated by Owner.
5. Protect items from damage during transport and storage.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Utilities to be Disconnected: Locate, identify, disconnect, and seal or cap off utilities serving buildings and structures to be demolished.

1. Owner will arrange to shut off utilities when requested by Contractor.
2. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.

3. Cut off pipe or conduit not less than 24 inches (610 mm) below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
4. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.4 PROTECTION

A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.

B. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of demolition.

C. Existing Utilities to Remain: Maintain utility services to remain and protect from damage during demolition operations.

1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.

a. Provide not less than 72 hours notice to occupants of affected buildings if shutdown of service is required during changeover.

D. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Section 015000 "Temporary Facilities and Controls."

1. Protect adjacent buildings and facilities from damage due to demolition activities.
2. Protect existing site improvements, appurtenances, and landscaping to remain.
3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
5. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
6. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
7. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.

E. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.5 DEMOLITION, GENERAL

A. General: Demolish indicated buildings and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
2. Maintain fire watch during and for not less than two hours after flame-cutting operations.
3. Maintain adequate ventilation when using cutting torches.
4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

B. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.
2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

C. Explosives: Use of explosives is not permitted.

3.6 DEMOLITION BY MECHANICAL MEANS

A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.

B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.

C. Salvage: Items to be removed and salvaged are indicated on Drawings.

D. Below-Grade Construction: Abandon foundation walls and other below-grade construction. Cut below-grade construction flush with grade.

E. Below-Grade Construction: Demolish foundation walls and other below-grade construction.

1. Remove below-grade construction, including basements, foundation walls, and footings, completely unless otherwise indicated.

F. Existing Utilities: Demolish and remove existing utilities and below-grade utility structures unless otherwise indicated.

3.7 SITE RESTORATION

A. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.

3.8 REPAIRS

A. Promptly repair damage to adjacent buildings caused by demolition operations.

3.9 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and recycle or dispose of them according to Section 017419 "Construction Waste Management and Disposal."

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Do not burn demolished materials.

3.10 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.

1. Clean roadways of debris caused by debris transport.

END OF SECTION 024116

This page intentionally left blank.

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

B. Related Requirements:

1. Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 013200 "Construction Progress Documentation" for preconstruction photographs taken before selective demolition.
3. Section 017300 "Execution" for cutting and patching procedures.
4. Section 024116 "Structure Demolition" for demolition of buildings, structures, and site improvements.
5. Section 028213 "Asbestos Abatement" for asbestos abatement.
6. Section 028319.13 "Lead-Based Paint Abatement" for lead-based paint abatement.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control, and for noise control. Indicate proposed locations and construction of barriers.

C. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

D. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Submit before Work begins.

1. Comply with Section 013233 "Photographic Documentation."

E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

F. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.7 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.8 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Universal certified by EPA-approved certification program.

1.9 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

1. During the construction of Instructional Building #2, Owner will occupy existing Buildings D, E, and F that are to be demolished. After the Owner moves into Instructional Building #2, existing Buildings D, E, and F, roof structures, and associated site work can be demolished.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

1. Before selective demolition, Owner will remove the following items:

a. Furniture, fixtures, and equipment.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.
2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
3. See Section 024116 "Structure Demolition" for removal of hazardous materials in existing Buildings D, E, and F.

E. Size Limitations in Existing Spaces: Materials, products, and equipment used for performing the Work and for transporting debris, materials, and products shall be of sizes that clear surfaces within existing spaces, areas, rooms, and openings, including temporary protection, by not less than 12 inches (300 mm).

F. Storage or sale of removed items or materials on-site is not permitted.

G. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.10 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding.

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.11 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Standards: Comply with ASSE A10.6 and NFPA 241.

2.2 REGULATORY REQUIREMENTS

A. Comply with governing EPA notification regulations before beginning selective demolition.

B. Comply with hauling and disposal regulations of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

D. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.

E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

F. Survey of Existing Conditions:

1. Record existing conditions by use of preconstruction photographs, preconstruction video recordings, or preconstruction photographs and preconstruction video recordings.
2. Record existing conditions to be replicated by use of measured drawings, templates, and preconstruction photographs, preconstruction video recordings, or preconstruction photographs and preconstruction videotapes.
3. Comply with requirements specified in Section 013233 "Photographic Documentation."
4. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
5. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.4 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain fire watch during and for not less than two hours after flame-cutting operations.
6. Maintain adequate ventilation when using cutting torches.
7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

10. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.

B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and recycle or dispose of them according to Section 017419 "Construction Waste Management and Disposal."

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

3.8 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 031000 - CONCRETE FORMS

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Forms for all cast-in-place concrete indicated on the Drawings and subsequent removal of forms, except those earth forms described in this Section.

1.2 RELATED SECTIONS

A. Section 03 20 00 - Concrete Reinforcement
B. Section 03 30 00 - Cast-in-place Concrete

1.3 QUALITY ASSURANCE

A. Qualifications of workmen: All workmen shall be experienced mechanics. Provide one person who shall be present at all time during execution of this portion of the work who shall be thoroughly familiar with the type of material being installed, the referenced standards and the requirement of this Work and shall direct all Work performed under this Section.
B. Codes and Standards: In addition to complying with all pertinent codes and regulations, comply with all pertinent recommendations contained in "Recommended Practice for Concrete Formwork," publication ACI 347R and ACI 318, Section 6.1.
C. Where provisions of pertinent codes and standards conflict with the requirement of this Section, the more stringent provision shall govern.
D. All Structural Concrete foundations, walls, floors, beams, roofs, columns, and any other structural component requiring structural forming or shoring shall be Engineer Designed Systems with calculations and erection drawings provided by the Contractor. Contractor is to secure the services of a California Registered Structural Engineer for the design of Forming Systems.

1.4 PRODUCT HANDLING

A. Protection: Contractor is to protect all formwork materials before, during and after installation.
B. Damaged Forms: In the event of damage or misalignment, immediately make all repairs and replacement necessary at no additional cost to the Owner.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Form lumber: All form lumber shall be new except as allowed for re-use of forms in Part 3.00 of this Specification, and all form lumber shall be one of the following, a combination thereof, or an equal approved in advance by the Architect.

1. Plywood forms may be Plyform, Plyron, and bearing the label of the Douglas Fir Plywood Association.
2. Form-lumber may be; fir, larch, hemlock, or approved equal seasoned lumber and surfaced on all four sides.
3. Form sealers shall be liquid form oil.

B. Pan Joist Concrete Forming and Shoring System: Forming and shoring for Concrete joist and slabs shall be an Engineered system. Contractor shall engage a Structural Engineer experienced in forming design for the type of construction shown on the drawings. Structural calculations and forming and

shoring design erection drawings shall be provided.

C. Other form materials and/or forming systems may be used if approved by the Owner, Architect and Structural Engineer. A complete list of materials, manufacturers and methods of application are to be submitted to the Architect, in accordance with Section 01330, Submittals and 01630 Product Options and Substitutions.

2.2 TIES AND SPREADERS

A. Form ties shall be of proven types and shall be a type which does not leave an open hole through the concrete and which permits patching at every hole.
B. When forms are removed, all metal ties shall be removed and shall be flush with the concrete surface. No metal ties shall be exposed on the exterior of the walls.

2.3 ALTERNATE FORMING SYSTEMS

A. Alternate forming systems may be used if approved by the Structural Engineer

2.4 OTHER MATERIALS

A. All other form materials, not specifically described herein, but required for proper completion of concrete formwork, shall be as selected by the Contractor subject to approval by the Owner or Architect.

PART 3 – EXECUTION

3.1 INSPECTION

A. Contractor shall verify and be responsible for all-existing dimensions and elevations before any Work is done.
B. Inspect the installed Work of all other trades; verify that all such Work is complete, and that the installation of Formwork may begin.
C. Verify that forms have been constructed in accordance with all pertinent codes and regulations, referenced standards and the design.
D. Discrepancies: Do not proceed with installation in areas of discrepancy. Notify the Architect of all discrepancies. All discrepancies are to be fully resolved before proceeding with installation.

3.2 CONSTRUCTION FORMS

A. Forms are to be constructed sufficiently tight to prevent leakage of concrete, and able to withstand excessive deflection when filled with wet concrete. Forms shall be braced, anchored and properly aligned.
B. Layout and form all required cast-in-place concrete to the required dimensions indicated on the Drawings.
C. Care shall be exercised in the layout of forms to avoid the necessity for cutting, patching, or repair of concrete after it is in place.
D. Make provisions for all openings, offsets, recesses, anchorage, blocking and other requirements of the Work.
E. Perform all forming required for Work of other trades and do all cutting and repairing of forms required to permit such installations.
F. Carefully examine the Drawing and Specifications and verify with other trades for openings, reglets,

chases, and other items that are required in the forms.

G. Forms for pre-cast concrete shall be constructed to provide for shrinkage of the concrete, and shall be adequately braced. All edges shall have chamfer strips except as noted on Drawings.
H. Construct all forms true, plumb, and square within a tolerance of 1/8" in 12 feet.

3.3 EMBEDDED ITEMS

A. Provide, install and check all required steel frames, angles, grilles, bolts, inserts and other such items required to be anchored in the forms before the concrete is placed.

3.4 BRACING

A. Properly brace and tie the forms together so as to maintain size, shape, and alignment, and to provide safety to personnel.
B. Construct all bracing and supporting members of ample size and strength to safely support, without excessive deflection, all dead and live loads to which they may be subjected.

3.5 PLYWOOD FORMS

A. Plywood forms shall be designed for loads imposed. Nail the plywood panels directly to studs and apply in a manner to minimize the number of joints.
B. Make all panel joints tight butt joints with all edges true and square, if necessary, use tape to prevent excessive leakage.

3.6 FOOTING FORMS

A. Foundation forms are to be wood forms.
B. Earth forms may be used for footings provided the soil will stand without caving, as determined by the Architect (Structural Engineer) and the sides of the bank are made with a neat cut to the minimum dimensions indicated.

3.7 REUSE OF FORMS

A. Reuse of forms shall be subject to approval of the I.O.R.
B. Reuse of forms shall not delay or change the schedule for placement of concrete from the schedule if all forms were new.
C. Reuse of forms shall not affect the structural stability of the forms or the appearance of the finished concrete.

3.8 REMOVAL OF FORMS

A. Side forms of foundations may be removed 48 hours after placement of concrete. Where foundations are supporting lateral loads, forms shall not be removed until approved by the I.O.R.
B. Use care and diligence, and protect workmen, passers-by, and the installed work and materials of other trades. Forms shall not be removed until the concrete can support all loads.
C. Cut nails, tie wires and form ties off flush, leave all surfaces smooth and clean.
D. Remove metal spreader ties and fill in the resulting pockets to match the surrounding areas with grout or dry pack. Sack all exposed faces.
E. Fill all holes resulting from the use of bolts, ties, spreaders and sleeve nuts with cement grout applied under pressure by means of a grouting gun; grout shall be one part Portland cement, to two parts sand; apply grout immediately after removing forms.

3.9 CLEANING

A. Remove all forming material from the site and dispose of in approved dumps.
B. Clean area of all left over debris including stakes, ties, form boards, wires, concrete spills, etc., and leave area in a neat clean condition.

END OF SECTION

SECTION 032000 - CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 SUMMARY

A. General Provisions apply to this section.

B. Section Includes:

1. Concrete steel reinforcement as indicated.

C. Related Sections:

1. Section 03 10 00: Concrete Formwork.

2. Section 03 30 00: Cast-In-Place Concrete.

1.02 SYSTEM DESCRIPTION

A. Regulatory Requirements: Fabrication and placement of reinforcing shall be in accordance with requirements of CBC, Chapter 19A.

1.03 SUBMITTALS

A. Shop Drawings: Submit steel reinforcement Shop Drawings in accordance with ACI 315. Include assembly diagrams, bending charts and slab plans. Indicate lengths and location of splices, size and lengths of reinforcing steel.

B. Closeout Submittals: Record exact locations of reinforcing that vary from Shop Drawings.

1.04 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement:

1. Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice.

2. American Welding Society (AWS).

3. American Concrete Institute (ACI).

4. CBC, Chapter 19A, Concrete.

B. SOURCE QUALITY CONTROL: REFER TO DIVISION 01 SECTIONS FOR GENERAL REQUIREMENTS AND TO FOLLOWING PARAGRAPHS FOR SPECIFIC PROCEDURES. TESTING

ing conformance testing, select test Samples of bars, ties, and stirrups from the material at the Project site or from the place of distribution, with each Sample consisting of not less than two 18 inch long pieces, and perform the following tests according to ASTM A 615.

1. Identified Bars: If Samples are obtained from bundles as delivered from the mill, identified as to heat number, accompanied by mill analyses and mill test reports, and properly tagged with the identification certificate so as to be readily identified, perform one tensile and one bend test for each 10 tons or fraction thereof of each size of bars. Submit mill reports when Samples are selected.

2. Unidentified Bars: When positive identification of reinforcing bars cannot be performed and when random Samples are obtained, perform tests for each 2.5 tons or fraction thereof, one tensile and one bend test from each size of bars.

C. Certification of Welders: Shop and Project site welding shall be performed by certified welding operators.

1.05 DELIVERY, STORAGE AND HANDLING

A. Avoid exposure to dirt, moisture or conditions harmful to reinforcing.

B. Reinforcing steel bars, wire, and wire fabric shall be stored on the Project site to permit easy access for examination and identification of each shipment. Material of each shipment shall be separated for size and shape.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide reinforcing of sizes, gages and lengths indicated, bent to indicated shapes.

2.02 MATERIALS

A. Steel Reinforcing Bars: ASTM A 615 and A 706 for welding, grade 60 billet steel unless otherwise specified or indicated.

B. Bars or Rod Mats: ASTM A 184.

C. Wire Fabric for Reinforcement: ASTM A 185.

D. Tie Wire: ASTM A 82, fully annealed, copper-bearing steel wire, 16 gage minimum.

E. Chairs, Spacers, Supports, and Other Accessories: Standard manufacture conforming to ACI-315 fabricated from steel wire of required types and sizes. For reinforcement supported from grade, provide properly sized dense precast blocks of concrete.

2.03 FABRICATION OF REINFORCING BARS:

A. Comply with CRSI Manual of Standard Practice for Reinforced Concrete Construction for fabrication of reinforcing steel.

B. Bending and Forming: Fabricate bars of the indicated sizes and bend and form to required shapes and lengths by methods not injurious to materials. Do not heat reinforcement for bending. Bend bars No. 6 size and larger in the shop only. Bars with unscheduled kinks or bends are not permitted. Provide only tested and permitted bar materials.

C. Welding: Provide only ASTM A 706 steel where welding is indicated. Perform welding by the direct electric arc process in accordance with AWS D1.4 and specified low-hydrogen electrodes. Preheat 6 inches each side of joint. Protect joints from drafts during the cooling process; accelerated cooling is not permitted. Do not tack weld bars. Clean metal surfaces to be welded of loose scale and foreign material. Clean welds each time electrode is changed and chip burned edges before placing welds. When wire brushed, the completed welds must exhibit uniform section, smooth welded metal, feather edges without undercuts or overlays, freedom from porosity and clinkers, and good fusion and penetration into the base metal. Cut out welds or parts of welds deemed defective, using chisel, and replace with proper welding. Prequalification of welds shall be in accordance with CBC requirements.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Bars shall be bent cold. Bars partially embedded in concrete shall not be field bent except as indicated on reviewed Shop Drawings. Before installation, clean reinforcing of loose scale, rust, oil, dirt and any coating that could reduce bond.

B. Accurately position, install, and secure reinforcing to prevent displacement during the placement of concrete.

C. Provide metal chairs to hold reinforcement the required distance above form bottoms. In beams and slab construction, provide chairs under top slab reinforcement as well as under bottom reinforcement. Space chairs so that reinforcement will not be displaced during installation. Provide metal spacers to secure proper spacing. Stirrups shall be accurately and securely wired to bars at both top and bottom. At slabs, footings, and beams in contact with earth, provide concrete blocks to support reinforcement at required distance above grade.

D. Install and secure reinforcement to maintain required clearance between parallel bars and between bars and forms. Lapped splices shall be installed wherever possible in a manner to provide required clearance between sets of bars. Stagger lapped splices. Dowels and bars extending through construction joints shall be

secured in position against displacement before concrete is installed and subsequently cleaned of concrete encrustation's while they are still soft.

E. Do not install reinforcing in supported slabs and beams until walls and columns have been installed to underside of slabs and beams or until construction joints have been thoroughly cleaned. Reinforcing shall be inspected before placement of concrete and cleaned as required.

F. Use deformed bars unless otherwise indicated, except for spiral reinforcement.

3.02 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.03 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. General Provisions apply to this section.

B. Section Includes:

1. Cast-in-place concrete placement and finishing.

C. Related Sections:

1. Section 30 10 00: Concrete Forms and Accessories.

2. Section 03 20 00: Concrete Reinforcement.

1.02 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings indicating locations of cast-in-place concrete Work and accessory items such as vapor barriers. Include details and locations of reinforcing, embedded items, and interfacing with other Work.

B. Product Data:

1. Mix Design: Submit a concrete mix design for each mix that will be provided for the Work. Include water/ cement ratio, size of coarse aggregate and amount of any admixture. Predict minimum compressive strength, maximum slump and air content percentage.

2. Manufacturer of ready-mixed concrete shall deliver to the ior a certificate with each mixer truck. Certificate shall bear the signature of representative of the testing laboratory, and shall state quantity of cement, water, fine and coarse aggregate and admixtures.

C. Material Samples: Submit Samples illustrating concrete finishes, minimum 12 inches x 12 inches in size.

D. Certificates: Submit a notarized certificate that each of following conforms to standards indicated:

1. Aggregates – ASTM Standards C33

2. Admixtures - ASTM Standards C260

3. Curing materials - ASTM Standards C171

1.03 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement.

B. American Concrete Institute (ACI) Publication:

1. ACI 211 - Recommended Practice for Selecting Proportions of Concrete.

2. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

3. ACI 305 - Recommended Practice for Hot Weather Concreting.

4. ACI 306 - Recommended Practice for Cold Weather Concreting.

5. ACI 308 - Recommended Practice for Curing Concrete.

6. ACI 309 - Recommended Practice for Consolidation of Concrete.

C. American Society for Testing and Materials (ASTM) Standards:

1. ASTM A 185 - Welded Steel Wire Fabric For Concrete Reinforcement.

2. ASTM C 31 - Making and Curing Concrete Test Specimens in the Field.

3. ASTM C 33 - Concrete Aggregates.

4. ASTM C 39 - Compressive Strength of Cylindrical Concrete Specimens.

5. ASTM C 88 - Soundness of Aggregates by use of Sulphate or Magnesium Sulphate.

6. ASTM C 94 - Ready-Mixed Concrete.

7. ASTM C 143 - Slump of Hydraulic Cement Concrete.

8. ASTM C 150 - Portland Cement.

9. ASTM C 171 - Sheet Materials for Curing Concrete.

10. ASTM C 172 - Sampling Freshly Mixed Concrete.

11. ASTM C 173 - Air Content of Freshly Mixed Concrete by the Volumetric Method.

12. ASTM C 227 - Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method).

13. ASTM C 231 - Air Content of Freshly Mixed Concrete by the Pressure Method.

14. ASTM C 260 - Air-Entraining Admixtures for Concrete.

15. ASTM C 289 - Potential Reactivity of Aggregates (Chemical Method).

16. ASTM D 1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).

D. Continuous inspection shall be provided at the batch plant and for transit-mixed concrete to run check sieve analysis of aggregate, check moisture content of fine aggregate, check design of mix, check cement being used with test reports, check loading of mixer trucks, and certify to quantities of materials placed in each mixer truck.

E. Inspection shall be performed by a representative of a testing laboratory selected by the Owner. Owner will pay for inspection costs. Notify the laboratory 24 hours in advance of time concrete is to be mixed. Notify the laboratory of postponement or cancellation of mixing within at least 24 hours of scheduling time.

F. Continuous batch plant inspection requirement may be waived in accordance with CBC section 1929 A. 5. Waiver shall be in writing, including DSA approval.

G. Strength Test of Concrete: Refer to Section 01 45 23: Testing and Inspection.

1.04 DELIVERY, STORAGE AND HANDLING

A. Mixing and Placing Concrete: Refer to Section 01 45 23: Testing and Inspection.

B. Ready-mix concrete shall be mixed and delivered in accordance with ASTM C 94 and CBC Standard 19-3 and 19-4. Each batch of concrete delivered to the Project site shall be accompanied by a time slip bearing departure time and signature of batch plant supervisor. Concrete shall be placed within 90 minutes after start of mixing.

C. Store cement and aggregate materials so as to prevent their deterioration or intrusion by foreign matter. Deteriorated or contaminated materials shall not be furnished.

1.05 JOB CONDITIONS

A. Cold Weather Requirements:

1. Adequate equipment shall be provided for heating concrete materials and protecting concrete during freezing or near-freezing weather. Surfaces, in which concrete is to come in contact with, shall be free from frost or ice. No frozen materials or materials containing ice shall be furnished.

2. When placing concrete during freezing or near-freezing weather the mix shall have a temperature of at least 50 degrees F., but not more than 90 degrees F. when cement is added. Concrete shall be maintained at a temperature of at least 50 degrees F. for at least 72 hours after placing or until it has thoroughly hydrated. When necessary, concrete materials shall be heated before mixing. Special precautions shall be provided for protection of transit-mixed concrete.

B. Hot Weather Requirements:

1. During hot weather, proper attention shall be provided for ingredients, production methods, handling, placing, protection and curing, to prevent excessive concrete temperatures or water evaporation which could impair required strength or durability.

PART 2 - PRODUCTS

2.01 GENERAL

A. Ready-Mixed Concrete: Mix and deliver in accordance with requirements of CBC Chapter 1905A.

B. Strength of Concrete: Concrete, unless otherwise indicated or specified, shall be provided with a minimum ultimate 28-day strength of 3000 psi (f'c). For high-early-strength concrete, age for reaching the f'c shall be as indicated on Drawings.

2.02 MATERIALS

A. Cement: ASTM C 150 Type II Portland Cement. Furnished cement shall be as selected and reviewed for concrete proportioning.

B. Aggregates: Aggregates shall conform to ASTM C 33 and C 227 except as modified herein. Any suitable individual grading of coarse aggregate may be furnished, provided Grading of Combined Aggregate indicated in following table is obtained. Refer to Section 01 45 23: Testing and Inspection.

GRADING OF COMBINED AGGREGATE			
Sieve Sumber or Size in inches	**1-1/2" Maximum**	**1" Maximum**	**3/4" Maximum**
Passing a 2"	------	------	------
Passing a 1-1/2"	95-100	------	------
Passing a 1"	70-90	90-100	------
Passing a 3/4"	50-80	70-95	90-100
Passing a 3/8"	40-60	45-70	55-75
Passing a No. 4	35-55	35-55	40-60
Passing a No. 8	25-40	27-45	30-46
Passing a No. 16	16-34	20-38	23-40
Passing a No. 30	12-25	12-27	13-28
Passing a No. 50	2-12	5-15	5-15
Passing a No. 100	0-3	0-5	0-5

C. Water: Water shall be potable and free from deleterious matter.

D. Admixtures: CBC Chapter 19A, Section 1903A.6, Type A or D.

E. Expansion Joint Fillers: Preformed strips, non-extruding and resilient bituminous type, of thickness indicated, conforming to ASTM D 1751.

F. Curing Paper and Liquid Curing Compounds:

1. Curing Paper: A standard brand conforming to ASTM C 171, Type 1 - Regular, Kure-N-Seal.

2. Liquid Curing Compounds: A standard brand, clear liquid conforming to ASTM C 309, Master Builders, Grace, Antihydro.

G. Abrasive Aggregate: Norton Alundum, Union Carbide Carborundum, or equal, graded #12 through #30 sizes, color as selected by Architect.

H. Underlayment: Latex underlayment for filling low spots in concrete shall be Tile-Tex by Flintkote Co., Webtex #60 or Fixallatex by Dowman Products Co.

I. Vapor Barrier: ASTM D 21O3, polyethylene sheeting, clear, 10 mils minimum thickness, impact strength greater than 70 grams per mil, 10 feet minimum width. Provide minimum 2-inch wide waterproof plastic self-adhering tape for sealing edges and ends of sheeting.

1. Moisture barrier is required where an interior area is scheduled to receive moisture sensitive floor finishes.

J. Stair Strips and Nosing:

1. Fabricated from 6063-T5 extruded aluminum, mill finish. Anti-slip filler shall contain at least 60 percent virgin grain aluminum oxide abrasive. Binder shall be fully cured resilient type epoxy, with binder-to-filler ratio of 13 percent. The epoxy-abrasive filler shall extend over the curved front edge of the nosing and shall be securely bonded to the extruded aluminum base.

2. Manufactured by Wooster Products Inc. American Safety Tread Co. Inc., or equal.

3. Nosing and strips for concrete casting shall be provided with Sure-Hold anchors, chevron shaped continuous full length of nosing or strip.

4. Nosings and anchors for attachment to hydrated concrete stairs and wood stairs shall be similar to those specified below, except they shall be provided with countersunk holes for screws and fasteners.

5. Colors: As selected by Architect to contrast with stair color. Colors shall extend uniformly through the filler.

6. Strip and Nosing Types:

a. Nosings for sloped riser steel pan stairs: Type WP4J, 4-1/16 inches wide, 3/8 inch thick.

b. Nosings for new concrete stairs: Type WP4C, 4-1/16 inches wide, 3/8 inch thick, nose projects down 1/4 inch.

c. Nosings for square edged steel pan stairs: Type WP4SP, 4-1/16 inches wide, 3/8 inch thick nose.

d. Strips for recessing into concrete stairs: Type WP1A, except 2-1/4 inches wide, 3/8 inch thick. American Safety Tread Co., Type 24, or equal.

e. Strips for adhering to existing or hydrated concrete: Flex-Tred anti-safety strips, minimum 2-1/4 inches wide. Cut from rolls and round corners.

f. Strips for anchoring into wood or stone: American Safety Tread Co., Type 24H, or equal, with holes for fasteners, 2-1/4 inches wide.

PART 3 - EXECUTION

3.01 GENERAL

A. Time of Placing: Do not place concrete until reinforcement, conduits, outlet boxes, anchors, hangers, sleeves, bolts, and other embedded materials are securely fastened in place. Contact the IOR at least 24 hours before placing concrete; do not place concrete until inspected by the IOR.

B. Pouring Record: A record shall be kept on the Project site of time and date of placing concrete in each portion of structure. Such record shall be maintained on the Project site until Substantial Completion and shall be available for examination by the Architect and DSA.

3.02 PREPARATION

A. Moisture Barrier: Before installation of screeds and slab reinforcement, install a moisture barrier under slabs on grade. Place membrane in as large sheets as possible, lapped 12 inches at sides and ends, with top lap placed in the direction of the spreading of concrete. Extend membrane and lap at least 4 inches onto adjoining wall surfaces and seal with pressure-sensitive tape.

1. Install moisture barrier on minimum 2-inch bed of sand, unless otherwise indicated, over gravel base as indicated on the Drawings.

2. Patch punctures and tears in moisture barrier.

B. Reglets and Rebates:

1. Form reglets and rebates in concrete to receive flashing, frames and other equipment as detailed and required. Coordinate dimensions and locations required with other related Work.

2. If concrete slabs on grade adjoin a wall or other perpendicular concrete surface, form a reglet in wall to receive and carry horizontal concrete Work. Reglet shall be full thickness of the slab and shall be 3/4 inch wide, unless otherwise indicated. Requirement does not apply to exterior walks, unless specifically indicated.

C. Anchor Slots: Dove-tail anchor slots at concrete walls to receive masonry veneer shall be set vertically in forms, 24 inches maximum on centers measured horizontally. Anchor slots shall be No. 24 gage galvanized sheet steel with removable fiber filler to prevent seepage of cement in slot.

D. Screeds: Install screeds accurately and maintain at required grade or slab elevations after steel reinforcement has been installed, but before starting to place concrete. Install screeds adjacent to walls and in parallel rows not to exceed 8 feet on centers.

3.03 INSTALLATION

A. Conveying and Placing:

1. Concrete shall be placed only under direct observation of the IOR. Do not place concrete outside of regular working hours, unless the IOR has been notified at least 48 hours in advance.

2. Concrete shall be conveyed from mixer to location of final placement by methods, which will prevent separation or loss of materials.

3. Concrete shall be placed as nearly as practicable to its final position to avoid segregation due to re-handling or flowing. No concrete that has partially hydrated or has been contaminated by foreign materials shall be placed, nor shall re-tempered concrete or concrete which has been remixed after initial set be placed.

4. In placing concrete in thin sections, provide openings in forms, elephant trunks, tremies or other recognized devices, to prevent segregation and accumulation of partially hydrated concrete on forms or metal reinforcement above level of concrete being placed. Such devices shall be installed so that concrete will be dropped vertically. Unconfined vertical drop of concrete from end of such devices to final placement surface shall not exceed 6 feet.

5. Concrete shall be placed as a continuous operation until placing of panel or section is completed. Top surfaces of vertically formed lifts shall be level.

6. Concrete shall be thoroughly consolidated during placement, and shall be worked around reinforcement and embedded fixtures with mechanical vibrators.

7. Where conditions make consolidation difficult, or where reinforcement is congested, batches of mortar containing same proportions of cement, sand, and water as provided in the concrete, shall first be deposited in the forms to a depth of at least one inch.

B. Compaction and Screeding:

1. Tamp freshly placed concrete with a heavy tamper until at least 3/8 inch of mortar is brought to surface. Concrete shall then be tamped with a light tamper and screeded with a heavy straightedge until depressions and irregularities are eliminated, and surface is true to finish grades or elevations. Remove excess water and debris.

2. Where slabs are to receive separate cement finish or mortar setting bed, continued tamping to raise mortar to surface is not performed. Laitance shall be removed by brushing with a stiff brush or by light sandblasting to expose clean top surface of coarse aggregate.

C. Floating and Troweling:

1. When concrete has hydrated sufficiently, it shall be floated to a compact and smooth surface. After floating, wait until concrete has reached proper consistency before troweling. Top surfaces shall receive at least 2 troweling operations with steel hand trowel. Prior to and during final troweling, apply a fine mist of water frequently with an atomizing type fog sprayer. Omit troweling for slabs to receive a separate cement finish.

2. For interior finish slabs, final troweling shall provide a hard, impervious, and non-slip surfaces, free from defects and blemishes. Finished surface shall be within a tolerance of 1/8 inch in 10 feet. Avoid burnishing. Do not add cement or sand to absorb excess moisture.

a. Floor of Walk-In Refrigerator: Finish as specified above, to a smooth finish.

b. At gymnasium locker room floors shall be given a fine broom finish. After floating, and while the surface is still plastic, provide a fine textured finish by drawing a fine fiber bristle broom uniformly over the surface in one direction only. Floors sloped for drainage should be brushed in the direction of flow.

3. Exterior Paving and Cement Walks: Finish as specified above, except surface shall be given a non-slip broom finish to match Sample reviewed by the Architect.

4. Vertical concrete surfaces shall be finished smooth and free from marks or other surface defects.

D. Curing:

1. Concrete shall be maintained above 50 degrees F., and in a moist condition for 7 days after placing, except that high early strength concrete shall be maintained in a moist condition for 3 days.

2. Before applying curing paper, interior floor treated with colored hardener shall be given a heavy protective coat of colored wax left unpolished, and then immediately covered with paper. If wax is not applied within two hours after final troweling, concrete shall be sprayed with a fine water mist and maintained continuously moist until wax is applied, unless spraying is not recommended by hardener manufacturer. After other Work such as plastering and painting has been completed, curing paper shall be removed and waxed floors cleaned of protective wax coating.

3. Forms containing concrete, top of concrete between forms, and exposed concrete surfaces after removal of forms shall be maintained in a thoroughly wet condition for at least 7 consecutive days after placing.

4. If weather is hot or surface has dried out, spray surface of concrete slabs and paving with fine mist of water, starting not later than 2 hours after final troweling and continuing until sunset. Surface of finish shall be kept continuously wet until curing medium has been installed.

5. Immediately after finishing, roof slabs and monolithic floor finish to receive resilient floor covering shall be uniformly and completely coated with liquid curing compound.

    a. Install compound in a manner and quantity sufficient to produce a uniform continuous thin film of water-impervious membrane. Compound shall be installed in accordance with manufacturer's directions.

    b. Protect adjoining surfaces from damage during installation. If curing compound is not applied immediately, cover finished concrete with wet burlap or curing paper and keep concrete surface wet for a period not to exceed thirty hours following finishing of concrete. At end of that time, burlap or paper shall be removed and curing compound installed as specified above.

5. Immediately after finishing, monolithic floor slabs not scheduled to receive resilient floor covering shall be covered with curing paper. Paper shall be lapped 3 inches at joints and sealed with waterproof sealer. Edges shall be cemented to finish. Repair or replace paper damaged during construction operations.

6. Within 24 hours after finishing, exterior slabs and paving, and interior slabs to receive cement topping or mortar setting beds, shall be covered with sand to a depth of 2 inches and kept thoroughly wet for 7 days.

    a. Instead of sand covering, exterior walks and paving where no other surface treatment is specified, may be cured with clear liquid curing

compound immediately installed in accordance with manufacturer's directions.

E. Filling, Leveling and Patching:

1. Concrete slabs exhibiting high or low spots and indicated to receive resilient floor covering or soft floor covering, shall have surfaces repaired. High spots shall be honed, or ground with power-driven machines to required tolerances. Low spots shall be filled with latex underlayment, installed in strict accordance with manufacturer's written recommendations.

2. Holes resulting from form ties or sleeve nuts shall be solidly packed, through exterior walls, by pressure grouting with cement grout, as specified. Grouted holes on exposed surfaces shall be screeded flush and finished to match adjoining surfaces.

F. Cement Base: Cement base shall be of the height, thickness, and shape detailed. Base shall be reinforced with one inch mesh, 18 gage, zinc-coated wire fabric. Base finish mixture shall be one part Portland cement, 2 parts of fine aggregate and one part pea gravel. Colored cement base shall include a chemically inert mineral oxide pigment in the mix.

3.04 FINISHING

A. Soda and Acid Wash: Concrete surfaces to receive plaster, paint or other finish, and which have been formed by oil coated forms, shall be scrubbed with a solution of 1-1/2 pounds of caustic soda to one gallon of water. Surfaces where smooth wood or waste molds have been furnished shall be scrubbed with a solution of 20 percent muriatic acid. Wash with clean water after scrubbing.

B. Sacking: Exposed concrete curbs, walls, and other surfaces shall be sacked by an application of Portland cement grout, floated, and rubbed. Sacking shall not be performed until patching and filling of holes has been completed. Entire sacking operation for any continuous area shall be started and completed within the same day.

1. Mix one part Portland cement and 1-1/2 parts fine sand with sufficient water to produce a grout having consistency of thick paint. Wet surface of concrete sufficiently to prevent absorption of water from grout. Apply grout uniformly with a brush or spray gun, then immediately float surface with a cork or other suitable float, scouring wall vigorously.

2. While grout is still plastic, finish surface with a sponge-rubber float, removing excess grout. Allow surface to dry thoroughly, then rub vigorously with dry burlap to completely remove dried grout. No visible film or grout shall remain after rubbing with burlap.

C. Sandblasting: Exterior concrete surfaces to receive stucco dash coat finish, where plywood or other smooth forms have been furnished, shall be uniformly sand-blasted with sharp quartz sand under sufficient air pressure to remove dirt, form oil and other foreign materials, and roughen surface to provide a proper bond. Such surfaces shall be thoroughly washed with clean water after sandblasting.

D. Abrasive: Concrete stair treads, landings, ramps and steps on interior and exterior of buildings, and interior exposed concrete floors in shop buildings shall receive an abrasive finish. Abrasive grains in amount of 30 pounds per 100 square feet shall be evenly installed by dust-on method and embedded into surface during first troweling operation. Additional abrasive grains, in amount of 30 pounds per 100 square feet, shall then be evenly installed and embedded into surface during final troweling operation.

E. Floor Hardener: Exposed interior concrete floors throughout shall be treated with floor hardener, as specified. Install hardener after surface of concrete has reached the point where no excess moisture is present, but while it is still plastic. Hardener shall be installed as follows:

1. Colored Hardener: Install at rate of 40 pounds per 100 square feet of surface for initial application.

2. Gray (natural) Hardener: Install at rate of 20 pounds per 100 square feet of surface for initial application.

3. Hardener shall be evenly distributed and thoroughly floated into surface mortar with a wood float. An additional 20 pounds of hardener, colored or gray, specified as above, shall be installed over each 100 square feet, and troweled to an even surface having uniform color and texture.

F. Cement Grout and Dry-Pack Concrete: Cement grout shall be mixed at the Project site and shall be composed of one volume of Portland cement and 2-1/2 volumes of fine aggregate. Materials shall be mixed dry with sufficient water added to make mixture flow under its own weight. When grout is used as a dry pack concrete, add sufficient water to provide a stiff mixture, which can be molded into a sphere.

G. Broom Finish: Exterior stair treads and landings shall be provided with a non-slip broom finish in addition to abrasive finish specified.

H. Abrasive Stair Nosing: Nosing shall be installed according to manufacturers written recommendations.

3.05 EXPANSION AND CONSTRUCTION JOINTS

A. Construction Joints: Details and proposed location of construction joints shall be as indicated on the Drawings, located to least impair strength of structure, in accordance with the following:

1. Thoroughly clean contact surface by sand blasting entire surface not earlier than 5 days after initial placement.

2. A mix containing same proportion of sand and cement provided in concrete plus a maximum of 50 percent of coarse aggregate shall be placed to a depth of at least one inch on horizontal joints. Vertical joints shall be wetted and coated with a neat cement grout immediately before placing of new concrete.

3. Should contact surface become coated with earth, sawdust, or deleterious material of any kind after being cleaned, entire surface shall be re-cleaned before applying mix.

B. Expansion Joints: Provide expansion joints where indicated in walks and exterior slabs. Space approximately 20 feet apart, unless otherwise indicated. Joints shall extend entirely through slab with joint filler in one piece for width of walk or slab. Joint filler shall be 3/8 inch thick, unless otherwise indicated.

C. Tooled Joints: Slabs, walks and paving shall be marked into areas as indicated with markings made with a V-grooving tool. Marks shall be round-edged, free from burrs or obstructions, with clean cut angles and shall be straight and true. Walks, if not indicated, shall be marked off into rectangles of not more than 12 square feet and shall have a center marking where more than 5 feet wide.

3.06 TESTING

A. Molded Cylinder Tests:

1. Owner Consultant will prepare cylinders. Each cylinder shall be dated, given a number, point in structure from which sample was obtained, mix design number, mix design strength and result of accompanying slump test noted.

2. Separate tests of molded concrete cylinders obtained at same place and time shall be made at age of 3 days, 7 days, and 28 days. A strength test shall be the average of the compressive strength of 2 cylinders, obtained from the same sample of concrete and tested at 28 days or at test age designated for determination of f'c.

3. Test cylinders shall be prepared at the Project site and stored in testing laboratory in accordance with ASTM C 31, and tested in accordance with ASTM C 39.

B. Core Test: At request of the Architect, cores of hardened concrete shall be cut from portions of hydrated structures for testing, in accordance with CBC and ASTM C 42.

1. Provide 4 inch diameter cores at representative places throughout the structure as designated by the Architect.

2. In general, provide sufficient cores to represent concrete placed with at least one core for each 4,000 square feet of building area, and at least 3 cores total for each Project.

3. Where cores have been removed, fill voids with drypack, and patch the finish to match the adjacent existing surfaces.

C. Concrete Consistency: Measure consistency according to ASTM C 143. Test twice each day or partial day's run of the mixer.

D. Adjustment of Mix: If the strength of any grade of concrete for any portion of Work, as indicated by molded test cylinders, fall below minimum 28 days compressive strength

specified or indicated, adjust mix design for remaining portion of construction so that resulting concrete meets minimum strength requirements.

E. Defective Concrete:

1. Should strength of any grade of concrete, for any portion of Work indicated by tests of molded cylinders and core tests, fall below minimum 28 days strength specified or indicated, concrete will be deemed defective Work and shall be replaced or adequately strengthened in a manner acceptable to the Architect and DSA.

2. Concrete Work that is not formed as indicated, is not true within 1/250 of span, not true to intended alignment, not plumb or level where so intended, not true to intended grades and levels, contains sawdust shavings, wood or embedded debris, or does not fully conform to Contract provisions, shall be deemed to be defective Work and shall be removed and replaced.

F. Concrete for Equipment Pads, Mechanical and Electrical Work: Unless otherwise indicated, strength shall be 3,000 psi concrete. Exposed concrete shall be provided with a hand trowel finish with radius corners and edges. Form and place concrete where necessary as described in Section 30 10 00: Concrete Forms and Accessories, and reinforced as described in Section 03 20 00: Concrete Reinforcement. Calcium chloride shall not be furnished in any concrete mix provided for the installation of underground electrical conduits. For concrete encasement of more than one conduit, furnish 3/4 inch to 1 inch aggregate as specified for concrete mix.

3.07 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.08 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

This page intentionally left blank.

SECTION 033933.20 - VAPOR RETARDER CONCRETE CURING - NEW CONCRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Fluid applied vapor retarder spray applied to new concrete surfaces as a replacement for traditional curing and sealing compounds.

a. Apply fluid applied vapor retarder in areas where moisture sensitive flooring will be installed. Moisture sensitive flooring includes but is not limited to:

1) Wood flooring.
2) Wood athletic flooring.
3) Wood dance flooring.
4) Wood theater flooring.
5) Vinyl stair accessories.
6) Rubber stair accessories.
7) Vinyl molding accessories.
8) Rubber molding accessories.
9) Vinyl sheet flooring.
10) Rubber sheet flooring.
11) Vinyl tile flooring.
12) Rubber tile flooring.
13) Vinyl composition tile flooring.
14) Static-control sheet flooring.
15) Static-control tile flooring.
16) Linoleum sheet flooring.
17) Linoleum tile flooring.
18) Resilient athletic flooring.

B. Related Requirements:

1. Section 033000 "Cast-In-Place Concrete" for concrete slabs and finishing methods.
2. Section 096400 "Wood Flooring" for wood flooring.
3. Section 096466 "Wood Athletic Flooring" for wood athletic flooring.
4. Section 096466.10 "Wood Dance Flooring" for wood dance flooring.
5. Section 096466.20 "Wood Theater Flooring" for wood theater flooring.
6. Section 096513 "Resilient Base and Accessories" for vinyl and rubber stair accessories and vinyl and rubber molding accessories.
7. Section 096516 "Resilient Sheet Flooring" for vinyl and rubber sheet flooring.

8. Section 096516 "Hybrid Resilient Sheet Flooring - Carpet" for hybrid resilient sheet flooring and hybrid resilient tile flooring.
9. Section 096519 "Resilient Tile Flooring" for vinyl, rubber, and vinyl composition tile flooring.
10. Section 096536 "Static-Control Resilient Flooring" for static-dissipative and static-conductive tile and sheet flooring.
11. Section 096543 "Linoleum Flooring" for linoleum tile and sheet flooring.
12. Section 096566 "Resilient Athletic Flooring" for resilient athletic flooring.

1.03 COORDINATION

A. Coordinate requirements for under slab vapor retarder, concrete mix design, concrete placement, and concrete surface finishes.

B. Coordinate areas where moisture sensitive flooring will be installed with flooring installers.

1. Verify fluid applied vapor retarder and flooring adhesives are compatible.

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of cleaning, preparation, and coating product.

1. Include manufacturer's printed statement of VOC content.
2. Include manufacturer's recommended number of coats for each type of substrate and spreading rate for each separate coat.

1.06 INFORMATIONAL SUBMITTALS

A. Certificates: Provide written documentation, signed by an authorized representative of floor covering manufacturer(s) and adhesive manufacturer(s) that fluid applied vapor retarder is compatible with floor covering(s), adhesive(s), and installation materials and methods.

B. Test and Evaluation Reports: Submit current independent laboratory test reports, dated not more than 2 years prior to submittal, for required performance. Reports dated more than 2 years prior to submittal are not acceptable.

C. Manufacturer's Instructions: Include application processes and procedures. Include environmental limitations.

D. Field Quality Control Submittals: On site forms prepared by manufacturer's technical representative after observing beginning of installation and installed product verifying products and application methods used are acceptable for warranty.

E. Qualification Data: For Applicator, manufacturer, and testing agency.

1. Applicator Certificate: Valid manufacturers approved applicator's certificate for a warranted system.

F. Sample Warranty: For special warranty.

1.07 CLOSEOUT SUBMITTALS

A. Warranty Documentation: Written warranty, issued to Owner.

1. Product liability insurance certificate.
2. Post-installation moisture test results.

1.08 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer specializing in products meeting performance requirements.

1. Manufacturer maintains long term warranty product liability insurance in the amount of not less than $6,000,000 per occurrence with capability of listing Owner as additional insured.

B. Applicator Qualifications: An employer of workers trained and approved by manufacturer. Company approved, licensed, and certified for the application of manufacturer's product.

1.09 DELIVERY, STORAGE AND HANDLING

A. Deliver material to site in new, factory sealed containers the day of application.

1.10 FIELD CONDITIONS

A. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit fluid applied vapor retarder to be applied according to manufacturers' written instructions and warranty requirements:

1. Ambient temperature is not less than 45 deg F (7.2 deg C) and not more than 90 deg F (32.2 deg C) and will remain so for 24 hours.
2. Rain or snow is not predicted within 24 hours prior to, during, and after application.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Applicator agree to repair or replace materials that fail within specified warranty period.

1. Moisture-vapor-emission rate shall not exceed 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours per ASTM F1869 after fluid applied vapor retarder is completely cured.
2. Alkalinity level shall not exceed 9.0 pH after fluid applied vapor retarder is completely cured.
3. In the event flooring systems are damaged by substrate moisture-vapor-emission exceeding 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours per ASTM F 1869, floor coverings shall be repaired or replaced at no cost to Owner.

a. Repair and replacement to include substrate preparation, fluid applied vapor retarder, flooring materials, patching compounds and all required labor.

4. In the event flooring systems are damaged by substrate alkalinity exceeding 9.0 pH, floor coverings shall be repaired or replaced at no cost to Owner.

   a. Repair and replacement to include substrate preparation, fluid applied vapor retarder, flooring materials, patching compounds and all required labor.

5. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Water Vapor Transmission Rate: ASTM E96.

1. Less than 1.0 grains/sq. ft./hr.

B. Water Vapor Permeance: ASTM E96.

1. Less than 2.4 perms (inch-pounds).

C. Pull-Off Concrete Adhesion: ASTM D4541.

1. 100 percent concrete cohesive failure.

D. Alkali Resistance: ASTM D1308. 30 day exposure. 14 pH solution.

1. 100 percent resistant to exposure.
2. No physical damage.

E. Volatile Organic Compound (VOC) Content:

1. Less than 99 g/liter when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.02 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Finish Material Pollutant Control: Finish materials shall comply with CGBC Sections 5.504.4.1 through 5.504.4.6 per CGBC Section 5.504.4.

1. Paints and Coatings: Architectural paints and coatings shall comply with VOC limits in Table 1 of the ARB Architectural Coatings Suggested Control Measure, as shown in CGBC Table 5.504.4.3, unless more stringent local limits apply. The VOC content limit for coatings that do not meet the definitions for the specialty coatings categories listed in CGBC Table 5.504.4.3 shall be determined by classifying the coating as a Flat, Nonflat, or Nonflat-High Gloss coating, based on its gloss, as defined in Subsections 4.21, 4.36, and 4.37 of the 2007 California Air Resources Board Suggested Control Measure, and the corresponding Flat, Nonflat, or Nonflat-High Gloss VOC limit in CGBC Table 5.504.4.3 shall apply per CGBC Section 5.504.4.3.

C. VOC Content: Paints and coatings shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Floor Coatings: 100 g/L.

D. Low-Emitting Materials: Paints and coatings shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

E. Low-Emitting Materials: Paints and coatings shall comply with the requirements of authorities having jurisdiction.

2.03 FLUID APPLIED VAPOR RETARDER

A. Basis-of-Design Product: Subject to compliance with requirements, provide Synthetics International; Synthetic10-S, or comparable product by another manufacturer.

1. Single-component epoxy based.
2. Ultra-low VOC (less than 99 g/liter).
3. UV resistant.
4. pH resistant to 14 pH per ASTM D1308.
5. Moisture-Vapor-Emission Rate (MVER) reduction to less than 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours per ASTM F1869.

2.04 ACCESSORIES

A. Floor Patching: Cement patching products will require the use a non-porous primer as recommended by fluid applied vapor retarder manufacturer.

B. ASTM F1869 Water Vapor Emission Test Kits: American Moisture Test, Inc.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify concrete under slab vapor retarder, concrete mix design, concrete placement, and concrete surface finishes meet manufacturer's requirements for a warranted system. Required properties:

1. Under Slab Vapor Retarder:

a. Classification: Class A per ASTM E1745.
b. Thickness: Not less than 15 mils (0.38 mm) thick.
c. Install, lap, and tape under slab vapor retarder per ASTM E1643.

2. Concrete Mix Design:

a. Water-Cement Ratio: Not more than 0.45.

3. Concrete Placement:

a. Place concrete directly on under slab vapor retarder, without a sand barrier, in accordance with ACI 302.1R-8 flow chart.
b. Schedule concrete placement when rain or damp weather is not expected 24 hours prior to, during, and 24 hours after concrete placement.

4. Concrete Surface Finishes:

a. Concrete finish shall be a light steel trowel finish. Do not burnish, over finish, or create a glass-like finish.

B. Verify items which penetrate substrate to receive coating are securely installed.

3.02 MIXING

A. Mix fluid applied vapor retarder according to fluid applied vapor retarder manufacturer's written instructions.

3.03 APPLICATION

A. Apply fluid applied vapor retarder in areas where moisture sensitive flooring will be installed.

B. Install fluid applied vapor retarder according to fluid applied vapor retarder manufacturer's written instructions.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of fluid applied vapor retarder and to instruct Applicator on the product and application method to be used.

D. Start application of fluid applied vapor retarder in presence of fluid applied vapor retarder manufacturer's technical personnel.

E. Apply to clean, absorbent surfaces. Do not apply to surfaces that are burnished, over finished, or have a glass-like finish.

1. Apply to concrete surfaces as a replacement for curing materials.
2. Surface shall sustain foot traffic without marring.
3. Apply barrier within 12 hours of concrete placement.

F. Spray apply fluid applied vapor retarder directly on concrete surface using an electric sprayer unit.

G. Apply to concrete surfaces at manufacturer's specified rates for a warranted installation.

H. Comply with manufacturer's on-site representative's recommendations.

3.04 FIELD QUALITY CONTROL

A. Fluid Applied Vapor Retarder Testing:

1. Perform anhydrous calcium chloride test per ASTM F1869, at not less than 10 locations, as recommended by fluid applied vapor retarder manufacturer and flooring manufacturer. Verify maximum moisture-vapor-emission rate does not exceed 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
2. Test alkalinity using a digital pH meter per ASTM F710, at not less than 10 locations, as recommended by fluid applied vapor retarder manufacturer and flooring manufacturer. Verify alkalinity does not exceed 9.0 pH.
3. Submit a written report of each test, inspection, and similar quality-control service to Architect, Contractor, and fluid applied vapor retarder manufacturer prior to flooring installations.
4. Do not install flooring systems in areas where moisture-vapor-emission rate exceeds 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
5. Do not install flooring systems in areas where pH exceeds 9.0 pH.

B. Fluid applied vapor retarder will be considered defective if it does not pass tests and inspections.

1. Re-apply fluid applied vapor retarder in areas where moisture-vapor-emission rate exceeds 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours at no cost to the Owner.
2. Re-apply fluid applied vapor retarder in areas where pH exceeds 9.0 pH at no cost to the Owner.
3. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

C. Final Inspection: Arrange for fluid applied vapor retarder manufacturer's technical personnel to inspect fluid applied vapor retarder installation on completion.

1. Notify Architect and Owner 48 hours in advance of date and time of inspection.

3.05 CLEANING

A. Prior to the application of adhesive applied flooring, surfaces shall be cleaned using non-abrasive methods.

3.06 PROTECTION

A. Protect from foot traffic for not less than 2 hours.

B. Remove standing water from slab surfaces.

C. Protect from paint and contamination.

END OF SECTION 033933.20

This page intentionally left blank.

SECTION 042113.13 - BRICK VENEER MASONRY

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Anchored brick veneer masonry, not more than 5 inches (127 mm) thick, anchored to metal studs.

    a. Brick veneer masonry units shall be not more than 3-5/8 inches thick per City of Los Angeles Research Report RR 24560.
    b. Brick veneer masonry system shall weigh not more than 36 lb. per sq. ft. per City of Los Angeles Research Report RR 24560.

2. Anchored brick veneer masonry, not more than 5 inches (127 mm) thick, anchored to cast-in-place concrete.

    a. Brick veneer masonry units shall be not more than 3-5/8 inches thick City of Los Angeles Research Report RR 24560.
    b. Brick veneer masonry system shall weigh not more than 36 lb. per sq. ft. City of Los Angeles Research Report RR 24560.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for installing dovetail slots for masonry-veneer anchors.
2. Section 076200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.
3. Section 099623 "Graffiti-Resistant Coatings" for coating on exposed brick masonry surfaces.

1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Verification: For each type and color of the following:

1. Clay face brick, in the form of straps of not less than five bricks, showing full range of variation in texture and color.
2. Special brick shapes.
3. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project.
4. Weep holes and vents.
5. Accessories embedded in masonry.

1.04 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Material Certificates: For each type and size of the following:

1. Masonry units.

a. Include data on material properties and material test reports substantiating compliance with requirements.
b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
c. For exposed brick, include test report for efflorescence according to ASTM C 67.

2. Cementitious materials. Include name of manufacturer, brand name, and type.
3. Mortar admixtures.
4. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
5. Anchors, ties, and metal accessories.

C. Mix Designs: For each type of mortar. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.

D. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of brick to include in maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Brick: Furnish 50 of each type, size, and color installed.

1.07 QUALITY ASSURANCE

A. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.

1. Build sample panels for each type of exposed unit masonry construction in sizes approximately 60 inches (1500 mm) long by 48 inches (1200 mm) high by full thickness.
2. Build sample panels facing south.
3. Where masonry is to match existing, build panels adjacent and parallel to existing surface.
4. Clean one-half of exposed faces of panels with masonry cleaner indicated.
5. Protect approved sample panels from the elements with weather-resistant membrane.
6. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.

a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockup of typical wall area as shown on Drawings.

a. Include a sealant-filled joint not less than 16 inches (400 mm) long in each mockup.
b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches (300 mm) wide by 16 inches (400 mm) high.
c. Include through-wall flashing installed for a 24 inch (600 mm) length in corner of exterior wall mockup approximately 16 inches (400 mm) down from top of mockup, with a 12 inch (300 mm) length of flashing left exposed to view (omit masonry above half of flashing).
d. Include metal studs, sheathing, sheathing joint and penetration treatment, building wrap, foam-plastic board insulation, building paper, veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.

2. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.
3. Clean exposed faces of mockups with masonry cleaner as indicated.
4. Protect accepted mockups from the elements with weather-resistant membrane.
5. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
6. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
7. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

C. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

D. Handle units on pallets or flat bed barrows. Free discharge from conveyor units or transportation in mortar trays is not permitted.

1.09 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of veneer, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches (600 mm) down face of veneer, and hold cover securely in place.

B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry. Immediately remove grout, mortar, and soil that come in contact with masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.02 REGULATORY REQUIREMENTS

A. Comply with applicable provisions in CBC Section 1404.4.

B. Comply with applicable provisions in CBC Section 1405.6.

C. Comply with applicable provisions in CBC Section 1704A.

D. Comply with applicable provisions in CBC Chapter 21A.

E. Comply with applicable provisions in CBC Section 2103A.

F. Comply with applicable provisions in CBC Section 2104A.

G. Comply with applicable provisions in CBC Section 2105A.

H. If core testing is required by DSA, masonry removed by coring operations shall be replaced to match adjoining Work. Core testing shall comply with applicable provisions in CBC Chapter 21A.

I. Comply with applicable provisions in City of Los Angeles Research Report RR 24560.

1. Stud and anchor slot spacing shall not exceed 16 inches on center.
2. Each slot shall be attached to a No. 16 gage galvanized steel stud with No. 10 galvanized Tek screws at a maximum spacing of 12 inches on center, or attached to a Group II wood stud with 10d galvanized common nails or No. 10 by 2 inches corrosion resistant drywall screws at a maximum spacing of 12 inches on center.
3. Stud end connections and the stud element to which the slot is connected shall be investigated for design loads.
4. Narrow end of the anchor clip shall be inserted into the slot. Wide end of the clip shall be secured to No. 8 horizontal wire in horizontal mortar joints of veneer units. 6 inch minimum lap shall be provided for the horizontal wire.
5. Anchor clips shall be installed at maximum spacing of 16 inches on center horizontally and 12 inches on center vertically.
6. Veneer units for the system shall be not greater than 3-5/8 inches in thickness and weigh not more than 36 pounds per square foot.
7. Except as prescribed in City of Los Angeles Research Report RR 24560, installation of the veneer and its backing shall comply with Chapter 14 of the Los Angeles City Building Code.

2.03 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects will be exposed in the completed Work and will be within 20 feet (6 m) vertically and horizontally of a walking surface.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

D. Brick veneer masonry units shall be not more than 3-5/8 inches thick.

E. Brick veneer masonry system shall weigh not more than 36 lb. per sq. ft.

2.04 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Clay Face Brick: Facing brick complying with ASTM C 216, Grade MW, Type FBS.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Interstate Brick; 4 inch Emperor, or comparable product by another manufacturer.
2. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested according to ASTM C 67.
3. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
4. Size (Actual Dimensions): 3-9/16 inches (90.5 mm) wide by 3-9/16 inches (90.5 mm) high by 15-9/16 inches (395.3 mm) long.
5. Size (Nominal Dimensions): 4 inches (101.6 mm) wide by 4 inches (101.6 mm) high by 16 inches (406.4 mm) long.
6. Color: Match Architect's sample.

2.05 MORTAR MATERIALS

A. Premixed Mortar and Grout:

1. For Joints Not More Than 1/2 inch (13 mm) Wide:

a. Basis-of-Design Product: Subject to compliance with requirements, provide Laticrete; 1500 Sanded Grout, or comparable product by another manufacturer.

b. Color: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

2. For Joints More Than 1/2 inch (13 mm) Wide:

a. Basis-of-Design Product: Subject to compliance with requirements, provide Laticrete; Masonry Pointing Mortar, with the addition of 1776 Latex Admix, or comparable product by another manufacturer.
b. Color: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

B. Water: Potable.

2.06 TIES AND ANCHORS

A. General: Ties and anchors shall extend not less than 1-1/2 inches (38 mm) into veneer but with not less than a 5/8 inch (16 mm) cover on outside face.

B. Anchors, Ties, and Reinforcement: Coated or corrosion-resistant metal meeting or exceeding applicable standards:

1. Zinc-Coating Flat Metal: Hot-dipped in accordance with ASTM A 153, Class B2 for applicable size, with 1.5 ounces zinc per square foot.
2. Zinc-Coating of Wire: ASTM A 116, Class 3.

C. Relief Angles/Channels: Refer to Section 055000.

D. Veneer Anchors at Steel Studs:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Halfen; HFA, Fleming Masonry Anchoring System, or comparable product by another manufacturer.

a. Fleming Anchor Channels: 1 inch (25 mm) wide by 21/32 inch (17 mm) deep, with inturned lips, roll formed from 0.0336 inch (0.85 mm) thick, 22 gage, pre-galvanized steel strip. Mounting holes are prepunched at 12 inches (305 mm) on center.

1) Per LARR 24560.
2) Coordinate with detail 15/S-1.02.
3) Each channel shall be attached to a 16 gage galvanized steel stud with No. 10 galvanized Tek screws at not more than 12 inches on center.

b. Fleming Anchors are T-shaped and are stamped from 0.0785 inch (1.99 mm) thick, 14 gage, pre-galvanized steel strip, complete with central stiffening rib and two tabs.

1) Anchor length shall be sized to position joint wire within middle one-third of brick width.
2) Anchors shall be spaced not more than 16 inches o.c. horizontally and 12 inches o.c. vertically.

2. Fasteners: Corrosion resistant self-tapping self-drilling, zinc-plated, steel screw, with two No. 12 diameter stainless steel Type 304 shaft and head carbon steel tip screws by length required into steel

stud, encapsulated in a copolymer corrosion-resistant coating and provided with a neoprene sealing washer, equal to Dur-O-Wall D/A 807 or Hilti Kwik-Seal EPDM washer at each screw.

E. Veneer Anchors at Cast-in-Place Concrete:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Halfen; HFA, Fleming Masonry Anchoring System, or comparable product by another manufacturer.

   a. Fleming Anchor Channels: 1 inch (25 mm) wide by 21/32 inch (17 mm) deep, with inturned lips, roll formed from 0.0336 inch (0.85 mm) thick, 22 gage, pre-galvanized steel strip. Mounting holes are prepunched at 12 inches (305 mm) on center.

      1) Per LARR 24560.
      2) Coordinate with detail 15/S-1.02.
      3) Each channel shall be attached to a 16 gage galvanized steel stud with No. 10 galvanized Tek screws at not more than 12 inches on center.

   b. Fleming Anchors are T-shaped and are stamped from 0.0785 inch (1.99 mm) thick, 14 gage, pre-galvanized steel strip, complete with central stiffening rib and two tabs.

      1) Anchor length shall be sized to position joint wire within middle one-third of brick width.
      2) Anchors shall be spaced not more than 16 inches o.c. horizontally and 12 inches o.c. vertically.

2. Fasteners: 1/4 inch diameter by 2-1/2 inches long Hilti KH-EZ concrete screw anchor, or equal, unless otherwise indicated.

F. Reinforcing:

1. Joint Wires: Minimum No. 8 galvanized annealed steel wire, straightened.

   a. Wires shall be lapped not less than 6 inches.

2.07 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual", Section 076200 "Sheet Metal Flashing and Trim", and as follows:

1. Stainless Steel: ASTM A 240/A 240M or ASTM A 666, Type 304, 0.016 inch (0.40 mm) thick.
2. Fabricate continuous flashings in sections not less than 96 inches (2400 mm) long, but not more than 12 feet (3.7 m). Provide splice plates at joints of formed, smooth metal flashing.
3. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
4. Fabricate through-wall flashing with sealant stop where indicated. Fabricate by bending metal back on itself 3/4 inch (19 mm) at exterior face of wall and down into joint 1/4 inch (6 mm) to form a stop for retaining sealant backer rod.
5. Fabricate metal drip edges from stainless steel. Extend not less than 3 inches (76 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
6. Fabricate metal sealant stops from stainless steel. Extend not less than 3 inches (76 mm) into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch (19 mm) and down into joint 1/4 inch (6 mm) to form a stop for retaining sealant backer rod.

7. Fabricate metal expansion-joint strips from stainless steel to shapes indicated.

2.08 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler:

1. Provide continuous strip of 1/8 inch thick factory-installed permanently elastic, closed cell neoprene compressible foam or asphalt impregnated polyurethane foam with a density of approximately 30 pcf to act as a bond break.

a. NNI, manufactured by Williams Products, Inc., Troy, MI.
b. Emseal Soft Joint Seal, manufactured by Emseal Joint Systems.
c. NS Neoprene Sponge (Hohmann & Barnard).

2. Adhesive Strips: Hohmann & Barnard #FTS Foam-Tite Seal drip.

a. Provide adhesive strip on top side of drip plate to secure flashing in place.

B. Weep/Vent Products:

1. Polypropylene cellular drainage insert, 3/8 inch thick by 3-1/2 inches high by 3-1/2 inches deep, equal to Weep Vents manufactured by CavClear, Mortar Maze Weep Vent manufactured by Advanced Building Products, Wire-Bond Cell Vent No. 3601 manufactured by Masonry Reinforcing Corporation, or Cell Vent weep hole ventilator manufactured by Dur-O-Wall.

a. Match mortar color.

C. Cavity Drainage Material:

1. Thickness to match cavity width, free-draining mesh, made from polyethylene mesh and shaped to avoid being clogged by mortar droppings. Provide one of the following:

a. Mortar Break, manufactured by Advanced Building Products.
b. Mortar Net, manufactured by Mortar Net USA.
c. Mortar Stop, manufactured by Polytite Manufacturing Corporation.

2.09 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Basis-of-Design Product: Subject to compliance with requirements, provide PROSOCO, Inc.; Stand-Off Series, or comparable product by another manufacturer.

2.10 MORTAR MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Pigmented Mortar: Use colored cement product.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Application: Use pigmented mortar for exposed mortar joints.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

B. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

C. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

D. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

E. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested according to ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.03 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm) except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch (1.5 mm) from one masonry unit to the next.

3.04 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in bond pattern indicated on Drawings; do not use units with less-than-nominal 4 inch (100 mm) horizontal face dimensions at corners or jambs.

C. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

3.05 MORTAR BEDDING AND JOINTING

A. Lay masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.06 ANCHORED MASONRY VENEERS

A. Anchor masonry veneers to wall framing and cast-in-place concrete with masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached anchors through sheathing to wall framing and to cast-in-place concrete with metal fasteners of type indicated.
2. Embed connector sections and continuous wire in masonry joints.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 12 inches (305 mm) o.c. vertically and 16 inches (406 mm) o.c. horizontally, with not less than one anchor for each 2 sq. ft. (0.2 sq. m) of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 8 inches (203 mm), around perimeter.

B. Provide not less than 1 inch (25 mm) of airspace between back of masonry veneer and face of insulation.

1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.07 EXPANSION JOINTS

A. General: Install expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span expansion joints without provision to allow for in-plane wall or partition movement.

1. Build in compressible joint fillers where indicated.
2. Form open joint full depth of brick wythe and of width indicated, but not less than 1/2 inch (13 mm) for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."

B. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than 3/8 inch (10 mm).

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.08 LINTELS

A. Install steel lintels over all openings.

B. Provide not less than 8 inches (200 mm) of bearing at each jamb unless otherwise indicated.

3.09 FLASHING, WEEP HOLES, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. Extend flashing through veneer, across airspace behind veneer, and up face of sheathing not less than 8 inches (200 mm); with upper edge tucked under water-resistive barrier, lapping not less than 4 inches (100 mm). Fasten upper edge of flexible flashing to sheathing through termination bar.
3. At lintels and shelf angles, extend flashing not less than 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
4. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches (38 mm) or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
5. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
6. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall, and adhere flexible flashing to top of metal drip edge.

C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

D. Install weep holes in veneers in head joints of first course of masonry immediately above embedded flashing.

1. Use specified weep/vent products to form weep holes.
2. Use wicking material to form weep holes above flashing under brick sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
3. Space weep holes formed from wicking material 16 inches (400 mm) o.c.
4. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.
5. Trim wicking material flush with outside face of wall after mortar has set.

E. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

3.10 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.

C. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.

3.11 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.12 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches (100 mm) in each dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."

3. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042113.13

This page intentionally left blank.

SECTION 04 2100 - CLAY UNIT MASONRY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Brick masonry as indicated.
2. Reinforcing steel and dowels embedded in concrete.
3. Setting of anchors, bearing plates, and other Work to be embedded into masonry.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 01 45 23 - Testing and Inspection.
3. Section 03 10 00 - Concrete Forming.
4. Section 03 20 00 - Concrete Reinforcing.
5. Section 03 30 00 - Cast-In-Place Concrete.
6. Section 05 50 00 - Metal Fabrications.

1.02 REFERENCES

A. American Society of Testing and Materials (ASTM) Standards:

1. ASTM C5 – Standard Specification for Quicklime for Structural Purposes.
2. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made from Clay or Shale).
3. ASTM C67 – Standard Test methods for Sampling and Testing Brick and Structural Clay Tile.
4. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
5. ASTM C150 – Standard Specification for Portland Cement.
6. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes.
7. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale).
8. ASTM C270 – Standard Specification for Mortar for Unit Masonry.

9. ASTM C404 – Standard Specification for Aggregate for Masonry Grout.

10. ASTM C476 – Standard Specification for Grout for Masonry.

B. Masonry Standards Joint Committee (MSJC):

1. ACI 530.1/ASCE6/TMS602 – Specification for Masonry Structures.

2. ACI 530/ASCE5/TMS402 – Building Code Requirements for Masonry Structures.

1.03 SUBMITTALS

A. Mix Design: Submit grout and mortar mix designs. Mix designs shall be signed and sealed by a Civil or Structural Engineer registered in the State of California.

B. Product Data: Submit manufacturer's Product Data for assembly components, materials, and accessories. Submit certificates and data assuring that the proposed materials meet the specified ASTM standards.

C. Samples: Submit Samples for each type of required masonry unit, including reinforcement and accessories.

D. Shop Drawings: Indicate wall reinforcement, splice locations and bending diagrams.

E. Admixtures: Additives and admixtures to mortar and grout shall not be used unless approved by the enforcing agency. Submit product data for any proposed admixture.

1.04 QUALITY ASSURANCE

A. Comply with the requirements of Specification Section 01 4523 - Testing and Inspection

B. Examination: Brick masonry, including brick veneer, shall be continuously inspected during installation.

1. Test grout and mortar for compliance with Specifications.

2. Testing and Coring:

a. Test for compliance of brick, mortar and grout with 28-day strength requirements.

b. Repair brick masonry units after coring or other testing is performed.

C. Mock-up: Provide a minimum 100 square foot mock up of corner condition, parapet, and window opening.

1.05 DELIVERY, STORAGE AND HANDLING

A. Store brick masonry units above grade on a level platform to provide air circulation under stacked units.

B. Cover and protect brick masonry units from becoming wet before installation.

C. Store cementitious ingredients in weather tight enclosures.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Higgins Brick Co., Redondo Beach, CA.

B. Pacific Claybrick Products, Lake Elsinore, CA.

C. H. C. Muddox, Sacramento CA.

D. Equal.

2.02 MATERIALS

A. Common Brick: ASTM C62, Grade SW Type FBS.

B. Face Brick: ASTM C216, Grade SW Type FBS, size as indicated, color and texture as selected.

C. Mortar and Grout Sand: Natural sand or sand manufactured by crushing stone or gravel, conforming to ASTM C144, except that at least 3 percent shall pass a No. 100 sieve.

D. Pea Gravel for Grout: ASTM C33 and ASTM C227. Maximum size of aggregate shall be 3/8 inch.

E. Cement: ASTM C150, Portland cement, Type I or II low alkali.

F. Hydrated Lime: Standard brand conforming to ASTM C207, Type S; Kel-Crete may be substituted for lime.

G. Mortar Color: Pure mineral pigment, lime-proof, non-fading, designed for use in mortar. Color as selected by the Architect.

H. Water: Clean and potable, free from deleterious amounts of acids, alkalis, salts or organic materials.

I. Reinforcing: As specified in Section 03 2000 - Concrete Reinforcing.

J. Brick size: 7 5/8" wide x 3 5/8" tall x 15 5/8" long.

PART 3 - EXECUTION

3.01 EXAMINATION

A. A special inspector, approved by DSA to inspect the Work of this section, shall inspect brick masonry before and during installation. The Project Inspector shall be responsible for monitoring the work of the special inspector and testing laboratories to ensure that the testing program is satisfactorily completed.

B. Brick masonry units shall be clean and free of dirt, dust, and other deleterious substances before installation.

3.02 GENERAL

A. Install patterns and details, maintaining indicated face bond. Install courses level and true to line, each tier plumb, with clean, straight and uniformly thick joints. Provide vertical joints plumb from top to bottom in corresponding courses. Toothing is prohibited; hold racking to a minimum.

B. Set and install anchors, bolts, sleeves, and other required Work items.

C. Brick shall be damp when installed. Allow surface water to drain off before installing. During installation, brick shall demonstrate sufficient absorption to retain applied mortar and absorb excess grout water. Mortar shall remain plastic for leveling and plumbing without breaking mortar bond.

D. Brick shall be installed as full units except where otherwise detailed. Install in a full bed of unfurrowed mortar. Solidly fill head joints with mortar and install brick into position. If a brick must be moved or shifted after initial installation, remove setting mortar, thoroughly clean the brick, and install with fresh mortar.

E. Install brick with uniform joints, thickness as indicated; perform joint finishing while mortar is still soft. Trowel exposed exterior joints flush and tool with a round bar, or tool, to provide a dense slightly concave surface. Exposed interior joints shall be finished flush. Cut off unexposed joints flush with face of brick. Install brick in bond pattern indicated on Drawings.

F. Top surfaces of walls shall be maintained free of mortar and grout droppings. To continue installation of brick masonry, clean brick, joints, and dampen top of brick surfaces with water.

3.03 PREPARATION

A. Lime Putty: Manufactured from hydrated lime. Lime putty shall weigh no less than 83 pounds per cubic foot.

B. Mortar: One part Portland cement, at least ¼ part but not more than ½ part lime putty or dry hydrated lime, and not more than four parts of sand based on dry loose volumes. Mortar shall provide a minimum strength of 3,350 PSI and shall be Type S.

C. Grout: One part Portland cement to not more than three parts sand and at least one part, but not more than two parts pea gravel, based on dry loose volumes. Add sufficient water to cause grout to flow into joints of masonry. Grout shall attain a minimum strength of 2,000 psi. Use Sika Chemical Corporation Grout Aid per manufacturer's instructions.

D. Reinforcement: Clean of mill scale, loose rust, oil, and coatings, which would reduce bond. Securely anchor in place.

E. Measurement: Accurately measure materials in calibrated devices. Shovel measurements are not permitted. Allowance for bulking of sand when measured damp loose shall not exceed 20 percent.

F. Mixing: Place sand, cement, and water in mixer in that order for each batch of mortar or grout and mix as long as needed to secure a uniform mass, but in no case less than 10 minutes. Add lime for mortar after initial 2 minutes of mixing time. Furnish paddle type mixers of at least one-sack capacity. Batches requiring fractional sacks will not be permitted unless cement is weighed for each such batch. Mortar and grout awaiting installation shall be turned and remixed to maintain a workable mix. Re-tempering of grout is not permitted. Re-tempering of mortar shall

be performed by adding water into a mortar basin with additional mortar added to it. Re-tempering by dashing water over mortar is not permitted. Mortar or grout not installed within one hour after initial mixing shall be removed from the Work. Mortar shall be mixed and maintained on boards to a slump of 2 ¾-inch, plus or minus ¼ inch, using a truncated cone 2 to 4 inches, 6 inches high.

3.04 INSTALLATION

A. Brick Veneer:

1. Frame walls to receive brick veneer shall have sheathing covered with 15 pound asphalt saturated felt applied shingle fashion. Start at bottom of area to be covered, install sheets horizontally, and secure to sheathing with nails or screws spaced 16 inches on center along edges. Lap each succeeding sheet 3 inches over the one below.

2. Nail or screw continuous vertical galvanized anchor slots to each stud or support, as shown on the Drawings.. Install continuous 10 gage straight galvanized wires as detailed.

3. Install brick veneer on frame construction with a 1 ¼-inch minimum space between backing and backside of brick. Remove mortar projecting into space, which obstructs flow of grout. Install grout after each course is installed and puddle to eliminate voids and to solidly fill grout space. Where it is not possible to install grout, fill space solidly with mortar.

B. Brick Veneer on Concrete:

1. Anchor brick veneer to concrete walls by anchor slots spaced as shown on the Drawings and set into concrete. Install continuous 10 gage straight galvanized wires as detailed.

2. Install brick veneer with a one inch minimum grout space between concrete and backside of brick. Fill grout space as specified for frame construction.

C. Brick Veneer Planters:

1. Construct brick planter boxes and curbs or walls around planting areas as detailed. Provide weep holes by omitting mortar from every third vertical joint in lowest exposed course of brick.

2. Before installation of waterproofing, inside surfaces of planters shall be parged from footing to first mortar joint above finish grade of planting soil. Furnish cement mortar as specified for parging.

3.05 FINISHING

A. Upon completion, holes, cracks, and defects in mortar joints shall be neatly pointed with mortar and finished weather tight.

B. Maintain brick Work continuously moist with a nozzle-regulated fog spray for at least 3 days after installation.

3.06 TESTING

A. Samples: Mortar and grout Samples will be prepared by the special inspector. At the beginning of masonry Work, at least one test specimen each of mortar and grout shall be obtained on three consecutive days.

B. Grout test specimens shall be obtained from the mason's containers as it is being installed. Additional test specimens shall be obtained whenever any change in materials and conditions of the Work occur. At least three mortar cylinders and three grout prisms shall be obtained and tested for each 30 cubic yards or fraction thereof.

C. Test Specimens shall be stored and tested as specified for "Molded Cylinder Test" for concrete as specified in Section 03 3000 - Cast-In-Place Concrete. Minimum compressive strength of test specimens shall be as follows:

ITEM	7 days	28 days
Mortar	900 psi	1,900psi
Grout	1,200 psi	2,000 psi

D. At least two cores with a diameter of approximately 2/3 of wall thickness shall be obtained from each Project by the independent testing agency. At least one core shall be obtained from each building for each 5,000 square feet of wall area. One-half of the cores obtained shall be tested in compression normal to wall face and shall provide a strength of at least 1500 psi at 28 days. Cores shall be obtained and tested as specified for concrete core test in Section 03 3000 - Cast-In-Place Concrete. One-half of the cores shall be tested in shear, testing joint between unit and grout core, and shall provide unit shearing strength as required by CBC. Masonry cut or removed by coring operation shall be replaced with new masonry to match adjoining Work.

3.07 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.08 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

END OF SECTION

PAGE INTENTIONALLY BLANK

PAGE INTENTIONALLY BLANK

SECTION 051200 - STRUCTURAL STEEL

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section

B. Section Includes:

1. Structural steel.
2. Architecturally exposed structural steel.

C. Related Sections:

1. Section 01 45 23: Testing and Inspection.
2. Section 03 30 00: Cast-In-Place Concrete
3. Section 04 22 00: Concrete Unit Masonry
4. Section 05 30 00: Metal Decking
5. Section 05 50 00: Metal Fabrication
6. Section 07 81 00: Cementitious Fireproofing
7. Section 09 90 00: Paints and Coatings

1.02 REFERENCES

A. AISC MO15L – Manual of Steel Construction, Allowable Stress Design, 9th edition.
B. AISC S323 – Quality Criteria and Inspection Standards.
C. ASTM A36 – Structural Steel.
D. ASTM A53 – Hot Dipped, Zinc-Coated Welded and Seamless Steel Pipe.
E. ASTM A108 – Steel Bars, Carbon, Cold-Finished, Standard Quality.
F. ASTM A123 – Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products.
G. ASTM A153 – Zinc Coating (Hot Dip) on Iron and Steel Hardware.
H. ASTM A307 – Carbon Steel Externally Threaded Standard Fasteners.
I. ASTM A325 – High Strength Bolts for Structural Steel Joints.
J. ASTM A500 – Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
K. ASTM A653 – Sheet Steel, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated by the Hot-Dip Process.
L. ASTM C1107 – Packaged Dry, Hydraulic Cement Grout (Non-Shrink).
M. AWS A2.4 – Standard Welding Symbols.
N. AWS D1.1 – Structural Welding Code.
O. AWS WHB-1 – Qualification and Certification.
P. AWS A5.1 – Carbon Steel Covered Arc-Welding Electrodes.
Q. SSPC – Steel Structures Painting Council, SP-2, Hand Tool Cleaning.

R. CBC Chapter 22A, Division III – Allowable Stress Design and Plastic Design for Structural Steel Buildings.

S. ASTM A572 – Grade 50 – Structural Steel.
T. ASTM A108 – Standard Specification for Steel Bars, Carbon, Cold-Finish, Standard Quality.
U. AISC – American Institute of Steel Construction, Code of Standard Practice for Steel Buildings and Bridges, for Architecturally Exposed Structural Steel.
V. ASTM A992 – Steel for Structural Shapes For Use in Building Framing.
W. ASTM F1554 – Standard Specification for Anchor Bolts.
X. ASTM A780 – Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
Y. Federal Emergency Management Agency (FEMA)

1. FEMA 353 – Recommended Specification and Quality Assurance Guidelines for Steel Moment Frame Construction for Seismic Application, July 2000.
2. American Institute of Steel Construction (AISC) Seismic Provisions for Structural Steel Buildings, April 15, 1997 including Supplement No. 2, November 10, 2000.

1.03 SYSTEM DESCRIPTION

A. Regulatory Requirements:

1. Structural steel shall conform to CBC requirements, except that steel manufactured by acid Bessemer process is not permitted for structural purposes.
2. Sheet and strip steel other than those listed in CBC, if provided for structural purpose, shall comply with DSA requirements.

1.04 SUBMITTALS

A. Shop Drawings:

1. Submit Shop Drawings, including complete details and schedules for fabrication and shop assembly of members, and details, schedules, procedures and diagrams showing the sequence of erection. Fully detail minor connections and fastenings not shown or specified in the Contract Documents to meet required conditions using similar detailing as shown in the Contract Documents. Include a fully detailed, well controlled sequence and technique plan for shop and field welding that minimizes locked in stresses and distortion; submit sequence and technique plan for review by the Architect.

a. Include details of cuts, connections, camber, and holes in accordance with Figure 4.5 of AWS D1.1-02 or AISC Section J1.8, weld position plan and other pertinent data. Indicate welds by standard AWS symbols, and show size, length and type of each weld.

b. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed for Work specified in other section.

c. Erection and Bracing Plan and Erection Procedure: Submit an erection and framing plan, including columns, beams, and girders, prepared, signed and sealed by a structural engineer registered in the State of California in accordance with Title 8 CCR, Section 1710. Maintain a copy at the Project site as required by the California Division of Industrial Safety.

d. Submit a list of steel items to be galvanized.

B. Product Data:

1. Submit copies of fabricator's specifications and installation instructions for the following products. Include laboratory test reports and other data required demonstrating compliance with these Specifications:

a. Structural steel, each type; including certified copies of mill reports covering chemical and physical properties.
b. Welding electrodes.
c. Welding gas.
d. Unfinished bolts and nuts.
e. Structural steel primer paint.
f. High-strength bolts, including nuts and washers.

C. Manufacturer's Mill Certificate:

1. Submit, certifying that products meet or exceed specified requirements.

D. Mill Test Reports:

1. Submit manufacturer's certificates, indicating structural yield and tensile strength, destructive and non-destructive test analysis.

E. Charpy-V-Notch (CVN) Impact Test: Submit certified copies of Charpy-V-Notch (CVN) Impact Test by the manufacturer for applicable steel members and components.

1. Charpy-V-Notch (CVN) Impact Test for Base Metal: Moment frame columns, and girders subjected to Charpy-V-Notch impact test in accordance with "Seismic Provisions for Structural Steel Buildings", Part I, Section 6.3, as modified by Supplement 2.
2. Exception: Rolled shapes listed under Groups 4 and 5 of Table 2, Page 1-8 of the 9th edition of the AISC Manual of Steel Construction shall have the Charpy-V-Notch test, as specified above, performed on flange material at the juncture of the web and flange, shown in Figure C-A3 1C in AISC Manual – 9th edition.
3. Charpy-V-Notch test shall be performed by the manufacturer employing Test Frequency (P) in accordance with ASTM A 673 and utilizing standard specimen sizes shown in Figure 6 of ASTM E 23. The absorbed energy in a

CVN impact test shall not be less than that specified in Material Part 2 of this section.

F. Submit certified copies of tests by manufacturer for fine grain practice. Structural steel base material, as described above, shall be manufactured using fully killed fine grain practice having grain size number 5 or better as determined by ASTM E 112.

G. Weld Procedures: Submit weld procedures for all welding on project to Owner's testing laboratory for approval. After approval by testing laboratory, submit to Architect for record. Weld procedures shall be qualified as described in AWS D1.5, Section 5.12 or 5.13 for self shielded FCAW, Weld procedures shall indicate joints details and tolerances, preheat and interpass temperature, post-heat treatment, single or multiple stringer passes, peening of stringer passes for groove welds except for the first and the last pass, electrode type and size, welding current, polarity and amperes and root treatment. The welding variables for each stringer pass shall be recorded and averaged, from these averages the weld heat input shall be calculated. Submit the manufacturer's product data sheet for all welding material used.

H. Welder's Certificates: Field welders shall be Project certified in accordance with AWS D1. 1-02. Shop welders shall be Project certified for FCAWS in accordance with AWS D1. 1-02.

I. Test Reports: Submit reports of tests conducted on shop and field welded and bolted connections. Include data on type of test conducted and test results.

J. Welding Material Certification: Comply with FEMA 353, Part I, Section 1.4.6.3. Submit to Owner's testing laboratory.

1.05 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement, except as otherwise indicated:

1. American Institute of Steel Construction (AISC) "Code of Standard Practice for Steel Buildings and Bridges,
2. Perform welding in accordance with AWS Standards, AWS D1.1, and California Building Code Section 2205A.10 and approved weld procedure.

B. Shop fabrication shall be inspected in accordance with CBC.

C. Erect mock-up panel of fabricated structural steel meeting Architecturally Exposed Structural Steel tolerances for exposed areas. Approval by Architect is required. Mock-up to remain for comparison but may not be left as part of the work.

1.06 DELIVERY, STORAGE AND HANDLING

A. Store structural steel above grade on platforms, skids or other supports.

B. Protect steel from corrosion.

C. Store welding electrodes in accordance with AWS D 12.1.

D. Store other materials in a weather-tight and dry place until installed into the Work.

PART 2 - PRODUCTS

2.01 GENERAL

A. Stock Materials: Provide exact materials, sections, shapes, thickness, sizes, weights, and details of construction indicated on Drawings. Changes because of material stock or shop practices will be considered if net area of shape or section is not reduced thereby, if material and structural properties are at least equivalent, and if overall dimensions are not exceeded.

2.02 MATERIALS

A. Structural Steel: All wide flange shapes shall conform to ASTM A992 Grade 50. Moment Frame Base Plate shall be ASTM A572 Grade 50. Other steel shall conform to ASTM A36.
B. Unfinished Threaded Fasteners: ASTM A307, Grade A, regular low carbon bolts and nuts.
C. High-Strength Threaded Fasteners: ASTM A325, ASTM A490 or ASTM F1852 quenched and tempered, steel bolts, nuts and washers.
D. Primer: Lead-free metal primer, Tnemec 10-99, Rust-Oleum X-60, or equal.
E. Steel Pipe: ASTM A53, Type E or S, Grade B.
F. Structural Tubing:

1. Hot-formed, ASTM A501.
2. Cold-formed, ASTM A500, Grade B.

G. Galvanizing: ASTM A123.
H. Welding Electrodes: Provide electrodes recommended by manufacturer for seismic connections.

1. Comply with FEMA 353, Part I, Section 2.4.1., Supplemental Requirements or Welding Materials.

I. Shear stud connectors: ASTM A108, Grade 1015 forged steel, headed, uncoated, granular flux filled shear connector or anchor studs by Nelson Stud Welding Division of TRW, Lorain, OH, or equal.
J. Grout: ASTM C1107, non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 7,000 psi at 7 days; of consistency suitable for application and a 30 minute working time.

2.03 FABRICATION

A. Cleaning and Straightening Materials: Materials being fabricated shall be thoroughly cleaned of scale and rust, and straightened before fabrication. Cleaning and straightening methods shall not damage material. After punching or fabrication of component parts of a member, twists or bends shall be removed before parts are assembled.
B. Cutting, Punching, Drilling and Tapping: Unless otherwise indicated or specified, structural steel fabricator shall perform the cutting, punching, drilling and tapping of Work so that Work of other trades will properly connect to steel Work.

C. Milling: Compression joints depending on contact bearing shall be furnished with bearing surfaces prepared to a common plane by milling.

D. Use of Burning Torch: Oxygen cutting of members shall be performed by machine. Gouges greater than 3/16 inch that remain from cutting shall be removed by grinding. Reentrant corners shall be shaped notch free to a radius of at least 1/2 inch. Gas cutting of holes for bolts or rivets is not permitted.

E. Galvanizing: After fabrication, items indicated or specified to be galvanized shall be galvanized in largest practical sizes. Fabrication includes operations of shearing, punching, bending, forming, assembling or welding. Galvanized items shall be free from projections, barbs, or icicles resulting from the galvanizing process.

F. Welding:

1. Type of steel furnished in welded structures shall provide chemical properties suitable for welding as determined by chemical analysis. Welds shall conform to the requirements of CBC Chapter 17A. Conform to AWS D1.1, and CBC Chapter 22A, Division I, Section 2205A.10.
2. Materials and workmanship shall conform to the requirements specified herein and to CBC requirements, modified as follows:

    a. No welded splices shall be permitted except those indicated on Drawings unless specifically reviewed by the Architect.

    b. Drawings will designate joints in which it is important that welding sequence and technique be controlled to minimize shrinkage stresses and distortion.

3. Welding shall be performed in accordance with requirements of the AWS Structural Welding Code.

    a. Welded Joint Details: comply with FEMA 353, Part I, Section 4, Welded Joint Details and Section 5.5.1, Tack Weld.

4. Architecturally Exposed Structural Steel: Verify that weld sizes, fabrication sequence, and equipment used for Architecturally Exposed Structural Steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds ½ inch (13 mm) and larger. Grind flush butt welds. Dress exposed welds.
5. Remove erection bolts on welded, Architecturally Exposed Structural Steel; fill holes with plug welds; and grind smooth at exposed surfaces.

G. Shop Finish:

1. Notify the IOR when Work is ready to receive shop prime coat. Work shall be inspected by the IOR before installation of primer.
2. Structural steel and fittings, except galvanized items, which will be exposed when building is completed, shall receive a coat of primer.
3. The primer specified shall be spray applied, filling joints and corners and covering surfaces with a smooth unbroken film. The minimum dry film thickness of the primer shall be 2.0 mils.
4. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete or high strength bolted.

H. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.

I Fabricate Architecturally Exposed Structural Steel with exposed surfaces smooth, square, and free of surfaces blemishes, including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness.

1. Remove blemishes by filling, grinding, or by welding and grinding, prior to cleaning, treating and shop priming.
2. Comply with fabrication requirements, including tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for Architecturally Exposed Structural Steel.

J. Architecturally Exposed Structural Steel: use special care in unloading, handling and erecting the steel to avoid marking or distorting the steel members. Minimize damage to any shop paint when temporary braces or erection clips are used. Avoid unsightly surfaces upon removal. Grind smooth tack welds and holes filled with weld metal or body solder. Plan and execute all operations in such a manner that the close fit and neat appearance of the structure will not be impaired.

K. Reduced Beam Sections (RBS's): Fabrication of RBS's as defined in FEMA 350, 3.5.5, shall conform with FEMA 353, Part I, Section 5.1.

2.04 SHOP AND FIELD QUALITY CONTROL

A. A special inspector, approved by DSA to inspect the Work of this section, shall inspect high-strength bolted connections. The Owner will provide a DSA approved independent testing laboratory to perform tests and prepare test reports in accordance with CBC 2231. The IOR shall be responsible for monitoring the work of the special inspector and testing laboratories to ensure that the testing program is satisfactorily completed.

B. An AWS CWI certified special inspector, approved by DSA to inspect the Work of this section, shall inspect welded connections. The Owner will provide a DSA approved independent testing laboratory to perform tests and prepare test reports in accordance with CBC 2231. The IOR shall be responsible for monitoring the work of the special inspector and testing laboratories to ensure that the testing program is satisfactorily completed.

C. The independent testing laboratory shall conduct and interpret test and state in each report whether test specimens comply with requirements, and specifically state any deviations there from.

D. Provide access to all places where structural steel Work is being fabricated or produced so required inspection and testing can be performed.

E. The independent testing laboratory may inspect and/or test structural steel at plant before shipment; however, Architect reserves the right at any time before Final Completion to deem materials not in compliance with the specified requirements as defective Work.

F. Correct defects in structural Work when inspections and laboratory test reports indicate noncompliance with specified requirements. Perform additional tests as may be required to reconfirm noncompliance of original Work, and as may be required to show demonstrate compliance of corrected Work.

G. Welding: Inspect and test during fabrication and erection of structural steel assemblies as follows:

1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in the Work. Record Work required and performed to correct deficiencies.
2. Inspect welds. Welds shall be visually inspected before performing any non-destructive testing. Groove weld shall be inspected by ultrasonic or other approved non-destructive test methods. Testing shall be performed to AWS D1.1 Table 6.3 cyclically loaded non-tubular connections.
3. Ultrasonic testing shall be performed by a specially trained and qualified technician who shall operate the equipment, examine welds, and maintain a record of welds examined, defects found, and disposition of each defect. Repair and test defective welds.
4. Rate of Testing: Completed welds contained in joints and splices shall be tested 100 percent either by ultrasonic testing or by radiography.
5. Welds, when installed in column splices, shall be tested by either ultrasonic testing or radiography.
6. Base metal thicker than 1-1/2 inches, when subjected to through-thickness weld shrinkage strains, shall be ultrasonically inspected by shear wave methods for discontinuities directly behind such welds. Tests shall be performed at least 48 hours after completed joint has cooled down to ambient air temperature.
7. Any material discontinuities shall be reviewed based on the defect rating in accordance with the criteria of AWS D1.1 table 6.3 by the Architect and DSA.
8. Other method of non-destructive testing and inspection, for example, liquid dye penetrate testing, magnetic particle inspection or radiographic inspection may be performed on weld if required.
9. Lamellar Tearing: Lamellar-tearing resulting from welding is a crack (with ero tolerance) and shall be repaired in accordance with AWS D1.1.
10. Lamination: The rejection criteria shall be based on ASTM A 435.
11. Where testing reveals lamination or conditions of lamellar tearing in base metal, the steel fabricator shall submit a proposed method of repair for review by the Architect. Test repaired areas as required.
12. Magnetic Particle Testing: Magnetic particle testing when required shall be provided in accordance with AWS D1.1 for procedure and technique. The standards of acceptance shall be in accordance with AWS D1.1 – Qualification.

H. Lamellar Tearing: Prior to welding plates 1 to 1-1/2 inches thick and greater and rolled shapes within the distance from 6 inches above the top of the joint to 6 inches below the bottom of the joint shall be checked by ultrasonic testing for laminations in base metal which may interfere with the inspection of the completed joint. Should these defects occur, members will be reviewed by the Architect and DSA. Welding procedure specifications in sub-section 1.5G specify welding practices to minimize lamellar tearing.

I. Prior Testing of Base Material: Test material before fabrication.

J. Lines and levels of erected steel shall be certified by a State of California licensed surveyor as set forth in related Division 01 section.

K. Welded studs shall be tested and inspected by the special inspector in accordance with requirements of AWS D1.1 – Stud Welding.

L. Record Drawings: After steel has been erected, correct or revise Shop Drawings and erection diagrams to correspond with reviewed changes performed in the field.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verify governing dimensions and conditions of the Work before commencing erection Work.

1. Report discrepancies between drawings and field dimensions to Architect before commencing work.
2. Beginning of installation means erector accepts existing conditions and surfaces underlying or adjacent to work of this section.

B. Provide temporary shoring and bracing, and other support during performance of the Work. Remove after steel is in place and connected, and after cast-in-place concrete has reached its design strength.

3.02 ERECTION

A. Install structural steel accurately in locations, to elevations indicated, and according to AISC specifications and CBC requirements.

B. Clean surfaces of base plates and bearing plates.

1. Install base and bearing plates for structural members on wedges, shims, or setting nuts as required.
2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims; cut off flush with edge of base or bearing plate before packing with grout.

C. Maintain erection tolerances of structural steel within AISC Code of Standard Practice for Steel Buildings and Bridges.

1. Members and components, plumbed, leveled and aligned to a tolerance not to exceed one-half the amount permitted for structural steel. Contractor to provide adjustable connections between Architecturally Exposed Structural Steel and the structural steel frame or the masonry or concrete supports, in order to provide the erector with means for adjustment.

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact after assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.

E. Do not permit thermal cutting during erection of structural steel.

F. Where indicated for field connections, provide standard bolts complying with ASTM A 307.

G. Install high strength steel bolts at locations indicated. Assembly and installation shall be in accordance with CBC requirements.

1. Allowable hole sizes: 1/16 inch larger than bolt size.
2. Use friction type connection with standard hardened steel circular, square or rectangular washer under bolt nut.

3. Thoroughly clean area under bolt head, nut and washer. Remove all paint, lacquer, oil or other coatings except organic zinc-rich paints in accordance with SSPC, SP-2.
4. Tighten bolts by power torque wrench or hand wrench until twist-off.

H. Contractor shall be responsible for correcting detailing and fabrication errors and for correct fitting of all members and components.

I. Erect structural steel plumb and level and to proper tolerances as set forth in the AISC Manual. Provide temporary bracing, supports or connections required for complete safety of structure until final permanent connections are installed.

J. Install column bases within a tolerance of 1/8 inch of detailed centerlines, level at proper elevations. Support bases on double nuts and solidly fill spaces under bases with dry-pack cement grout.

K. Provide anchor bolts with templates and diagrams. Contractor shall be responsible for proper location and installation of bolts. Correct deficiencies and errors.

L. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint according to ASTM A780.

3.03 FITTING

A. Closely fit members, finished true to line and in precise position required to allow accurate erection and proper joining in the field.

B. Drilling to enlarge unfair holes will not be allowed. Allow only enough drifting during assembly to bring parts into position, but not sufficient enough to enlarge holes or distort the metal. Do not heat rolled sections, unless approved by Architect.

3.04 PUNCHING AND DRILLING

A. Punch material 1/16 inch larger than nominal diameter of bolt, wherever thickness of metal is equal to or less than the diameter of the bolt plus 1/8 inch.

B. Drill or sub-punch and ream where metal is equal to or more than the diameter of the bolt plus 1/8 inch. Make diameter for sub-punched and sub-drilled holes 1/16 inch larger than nominal diameter of bolt.

C. Precisely locate holes to ensure passage of bolt through assembled materials without drifting. Enlarge holes when necessary to receive bolts by reaming; flame cutting to enlarge holes is not acceptable. Structural Steel members with poorly matched holes will be rejected.

3.05 FINISHING

A. After erection, spots or surfaces where paint has been removed, damaged, or burned off and field rivets, bolts, and other field connections not concealed in the work, shall be cleaned of dirt, oil, grease, and burned paint and furnished with a spot coat of the same primer installed during shop priming.

B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Install paint to exposed areas with the same material installed during shop painting. Install by brush or spray to provide a minimum dry film thickness of 1.5 mils.

3.06 FIELD QUALITY CONTROL

A. Owner will provide a special inspector and independent testing laboratory to perform field inspections and tests and to prepare test reports.

B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

3.07 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project Site.

3.08 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.09 HANDLING

A. Both in shop and in the field, transport, handle and erect to prevent damage or overstressing of any component.

END OF SECTION

This page intentionally left blank.

SECTION 051200.01 - STRUCTURAL STEEL – FOR BUCKLING-RESTRAINED BRACES

PART 1 – GENERAL

1.1 SUMMARY

A. Provide all parts, materials, and labor required for the design, delivery, testing and erection of buckling-restrained braces, which are designed by the manufacturer to meet stiffness, yield strength, and elongation requirements as indicated on the Drawings and other requirements specified Herein.

B. Related Sections

1. Section 01 45 23: Testing and Inspection.
2. Section 03 30 00: Cast-In-Place Concrete
3. Section 04 22 00: Concrete Unit Masonry
4. Section 05 30 00: Metal Decking
5. Section 05 50 00: Metal Fabrication
6. Section 07 81 00: Cementitious Fireproofing
7. Section 09 90 00: Paints and Coatings

1.2 REFERENCES

A. The following applicable standards are to be adhered to unless indicated otherwise.

B. American Institute of Steel Construction (AISC):
1 "Code of Standard Practice for Steel Buildings and Bridges", latest edition.
2 2010 Seismic Provisions for Structural Steel Buildings (ANSI/AISC 341-10)

C. American Society for Testing and Materials (ASTM) Standard Specifications:
1. A6 – Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling, latest edition.
2. A36 – Specification for Carbon Structural Steel, latest edition.
3. A325– Specification for Structural Bolts, 120/105 ksi Minimum Tensile Strength, latest edition.

4. A490 – Specification for Structural Bolts, 150 ksi Minimum Tensile Strength, latest edition.
5. A500 – Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes, latest edition.
6. A572 – Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel, latest edition.
7. F959 – Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners, latest edition.
8. F1852 – Specification for "Twist-off" Type Tension Control Structural Bolts, 120/105 ksi Minimum Tensile Strength, latest edition
9. F2280 – Specification for "Twist-off" Type Tension Control Structural Bolts, 150 ksi Minimum Tensile Strength, latest edition

D. American Welding Society (AWS):
1. 2.4 – Standard Symbols for Welding, Brazing and Nondestructive Examination.
2. A5.1 –Specification for Carbon Steel Electrodes
3. A5.18 –Specification for Carbon Steel Electrodes and Rods for Gas Shielded Arc Welding
4. A5.20 – Carbon Steel Electrodes for Flux Cored Arc Welding
5. D1.1 – Structural Welding Code-Steel, latest edition.

E. Steel Structures Painting Council (SSPC):
1. Steel Structures Painting Manual, latest edition.

1.3 DEFINITIONS

A. Buckling-Restrained Brace (BRB): A steel brace consisting of an outer steel casing, an inner steel core, and a concrete matrix between the core and the outer steel casing. The inner steel core resists against tensile and compressive axial loads and is restrained from buckling by the concrete contained in the outer steel casing.

1.4 SUBMITTALS

A. The following submittals shall be made. All submittals shall be made in the English language.

B. Proposed Design of Buckling-Restrained Braces:
1. Design Drawings shall clearly display size, thickness and length of exterior brace casing as well as configuration and size of the full length of the core plates.

2. Calculations shall be provided to display the ability of the proposed "BRB's" to meet the Performance Criteria described herein.
3. Not used.
4. Preliminary design: At contractor's option, make an initial submittal of the above items without sealed S/P.E. stamp for review by project Structural Engineer of Record, Architect and Jurisdictional Authority and coordination with structural steel contractor. Once all reviews are complete and incorporated, resubmit with sealed S/P.E. stamps for record.

C. Shop Drawings
1. Shop drawings shall clearly display all geometries necessary to manufacture BRB's including plate thickness, lengths, plate dimensions inside and outside of the casing, and casing dimensions
2. Shop drawings shall clearly display all connection information including location of bolts, bolt types, bolt diameters, hole size, and faying surface types.

D. Material Test Reports
1. Tensile tests and chemical analysis for all steel.
2. Independent coupon tests used to verify core plate initial yield stress, tensile stress, and ultimate elongation.
   a. Where core plates are fabricated from plate material, coupon tests shall be performed on each plate.
   b. Where core plates are fabricated from bar stock, coupons shall be made at intervals of each 5 tons of material of same heat and thickness.
   c. Coupon tests to be taken at point of manufacture. Mill test reports (MTR) may not be used.
3. Plates 2 inches (50mm) and thicker shall be supplied with Charpy V-Notch testing in accordance with ASTM A673, Frequency P, or approved equal. The impact test shall meet a minimum average value of 20 ft-lbs absorbed energy at +70 degrees Fahrenheit and shall be conducted in accordance with AISC Specification, or approved equal.

E. Technical Report
1. The Manufacturer shall submit a BRB testing report. The testing configurations used, and the results obtained shall meet the criteria found in the AISC 2010 Seismic Provisions (341-10).

F. Welding Certificates
1. Welder Performance Qualification Records (WPQR's)

2. Welding Procedure Specification (WPS) written in conformance with AWS D1.1 for each proposed type of welded joint, whether pre-qualified or qualified by testing.

G. Manufacturer's Quality Assurance Plan

H. Manufacturer's in-house Quality Assurance Inspection Report for each brace upon completion of fabrication.

I. Outside Testing Agency Quality Control Report where applicable.

1.5 QUALITY ASSURANCE

A. The Manufacturer shall have a detailed Quality Assurance Plan.
   1. The Quality Assurance Plan shall contain the procedures for manufacturing buckling-restrained braces including:
      a. Welding procedures.
      b. Methodology for verifying and documenting material properties.
      c. Indication of how the product is to be identified, such that it can be traced back to production quality assurance records.
      d. A flow chart of the process by which the product is manufactured, including description of production methods.
      e. Identified manufacturing tolerances for each production process.
      f. In-process quality control including all points of internal inspection for control and monitoring of the fabrication and assembly process.
   2. Design Engineer Requirements: The Design Engineer shall be registered in the State of California, have experience with designing buckling-restrained braced frame systems, and have a thorough knowledge of the submitted BRB test report.
   3. Qualification testing shall conform to Article 2.5.

B. The Manufacturer shall notify Owner of fabrication schedule at least 30 days prior to fabrication in order to allow Owner or Owner's Representative to observe fabrication process.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Plants fabricating buckling-restrained braces shall comply with the following:
   1. Obtain and maintain accreditation from The American Institute of Steel Construction (AISC Certified Fabricator) in conjunction with any additional certifications required by the local jurisdiction.
   2. Have a minimum of 5 years of documented continuous experience in the fabrication of buckling-restrained braces with a minimum of 30 completed projects over this same period.
   3. Buckling-retrained braces for this project shall be manufactured in the same facility (following the same quality assurance procedures) as the braces manufactured and tested to fulfill the AISC 341 testing requirements.

B. Buckling-Restrained Braces shall be manufactured and supplied by the following vendor or equal.
   1. CoreBrace, LLC
      5789 West Wells Park Road
      West Jordan, UT 84081
      801.280.0701

C. Documentation showing evidence of valid accreditation and experience shall be submitted to the Engineer of Record during the bidding phase for any proposed manufacturer not listed above.

2.2 MATERIALS

A. Core Plate
   1. ASTM A36 with Fy as noted on the drawings.
      a. Fy of all core plate material shall be verified via coupon test per Article 1.4.D.2.
      b. Core plates 2 inches (50mm) and thicker shall be supplied with Charpy V-Notch testing per Article 1.4.D.3.
      c. If not noted on the drawings, use 38ksi ≤ Fy ≤ 46ksi

B. Casing
   1. ASTM A500, Gr. B or similar for square or rectangular sections.
   2. ASTM A500, Gr. B or A53, Gr. B or similar for round sections.

C. Primer
   1. Standard shop primer.

D. Bolts, Nuts, and Washers:

1. ASTM A325 or A490 for conventional high-strength bolts, ASTM A563 nuts.
2. ASTM 1852 or F2280 for twist-off type Tension Control Bolt/Nut/Washer Assemblies.

E. Welding Materials
1. Shielded metal arc welding electrodes conform to AWS A5.1, flux-cored arc welding electrodes conform to AWS A5.20, and electrodes used for gas metal arc or submerged arc conform to the requirements of AWS A5.18.
2. The minimum tensile strength of the E70 class electrodes used in production is 70,000 psi (470 MPa).
3. Materials shall provide production welds with minimum Charpy V Notch properties of 20 ft-lbs (27 J) at -20°F (-30 C).

F. Infill Grout
1. Manufacturer's standard infill that has been demonstrated suitable by sub-assemblage testing per the Recommended Provisions.

2.3 DESIGN REQUIREMENTS

A. A Structural Engineer shall design the buckling-restrained braces to meet the Performance Requirements. The Structural Engineer shall have a thorough knowledge of the qualifying cyclical tests and competently apply the test results to the Project conditions.

B. Interpolation or extrapolation of test results for different member sizes shall be justified by rational analysis that demonstrates stress distributions and magnitudes of internal strains that are consistent with or less severe than the tested assemblies and that considers the adverse effects of larger material and variations in material properties.

C. Stability calculations shall include beams, columns and gussets adjoining the BRB's.

D. End rotation effects corresponding to the larger of 2.0 times Design Story Drift or .025 radians minimum shall be considered.

E. Where bracing connections are designed by manufacturer they shall be designed to a minimum of 1.1 times the adjusted brace strength as defined in Article 2.4.F.

2.4 PERFORMANCE REQUIREMENTS

A. Core plate material shall have a yield range of 42 ksi within ±4 ksi unless indicated otherwise in the structural BRB drawings. Coupon tests taken from plates at point of manufacture of BRBs shall be used to verify conformance. Additional coupon tests may be performed to replace coupon tests that fall out of acceptable range.

B. Increasing amplitude cyclic displacement tests per the AISC Seismic Provisions shall provide stable performance up to a displacement corresponding to 2.0 x Design Story Drift.
   1. Hysteretic behavior shall display no post-yield loss of strength, degradation, or pinching.
   2. Fracture of any portion of the BRB shall not occur during the qualifying tests.
   3. The cumulative ductility factor requirement specified in AISC 341 shall be increased from 200 to 300.

C. The steel core shall resist compression and tension forces. The steel core area shall be as per the project drawings and based on the yield stress range specified.

D. The steel and concrete casing shall prevent the steel core from buckling globally and locally during compressive loading without binding due to longitudinal shortening and transverse expansion. Demand for local and global stability of casing checks shall be based on the adjusted brace strength at the maximum yield stress (Fysc,max) of the specified yield stress range of the core plate material.

E. Steel core projections beyond the steel casing and brace connections shall develop the adjusted brace strength without instigation of fracture or instability. For core plate checks use the minimum (Fysc,min) of the specified yield stress range for determining demand. For all other materials use Fysc,max to determine demand.

F. The overstrength factors (□□□□□□shall be determined at a brace strain level associated with the greater of a 2% interstory drift or twice the design story drift, the latter of which is taken as $(2□C_dF_{ysc,min})/(\rho I_eE)$. Where P_d is provided, twice the design story drift is taken as $(2C_dP_d)/(A_{sc}\rho I_eE)$. C_d is the design drift deflection amplification factor, E is the nominal modulus of elasticity of the core plate material, I_e is the Importance Factor, □ is the Redundancy Factor, and P_d is the demand in the BRBs at the controlling drift design load case with gravity loads excluded.

2.5 QUALIFICATION TESTS

A. Buckling-restrained brace design shall be based on two qualifying cyclic tests conforming to the AISC Seismic Provisions for Buckling Restrained Braced Frames. As stated in the Provisions, at least one of the two qualifying tests needs to be a subassemblage test to demonstrate the ability of the BRB to withstand rotational demands. The other test may be performed uniaxially or may also be a subassemblage test.

B. The requirements of the AISC 341 Seismic Provisions shall be met along with the modification in Article 2.4.B.3.

C. The strain level during testing shall be equivalent to, or greater than, the strains that the project braces will be expected to withstand.

D. Qualifying cyclical tests can be based on full-scale cyclical tests previously reported for projects, or research that are deemed similar to project conditions by the Manufacturer and Project Engineer.

PART 3 – EXECUTION

3.1 FABRICATION

A. Braces shall be fabricated in accordance with AISC Code of Standard Practice and in an AISC Certified Shop that participates in the AISC Quality Certification Program.

B. Core plates shall be cut to profile shown on Design Drawings.

1. The general roughness cannot exceed 1000 micro-inches in the yielding length.
2. Notches in yield length region up to 1/8–inch may be repaired by grinding to a smooth transition. The length of the transition shall not be less than 10 times the notch depth.
3. Notches in the yielding length region greater than 1/8–inch and less than or equal to 3/8–inch may be repaired using procedures outlined in the Company Quality Assurance Manual. The repairs shall be examined using Ultrasonic Testing (UT) procedures in conformance with AWS D1.1.
4. Notches in the yielding length region greater than 3/8–inch in the yield length shall be rejected.

C. No splices are allowed in the yielding region of the steel core plate.

D. Minimum casing dimensions shall be as required by manufacturer or as specified on the project documents.

E. Holes for bolted connections may be drilled, cut or punched in conformance with AISC standards and burs removed.

F. Finish shall be manufacturer's standard shop primer. Do not paint connection faying surfaces if connection are designated slip critical unless paint used provides same slip resistance

G. Assembly of the different components of the brace shall be done in accordance with the manufacturer's Quality Assurance Manual in a manner that ensures proper performance of the brace.

H. Pin-connection hole tolerance shall be +1/32", -0".

3.2 SHIPPING

A. Manufacturer to package BRB's for protection against shipping damage.

B. Manufacturer shall coordinate delivery dates and quantities with Contractor/Owner. Contractor/Owner shall provide adequate storage space and proper lay-down areas.

C. Braces shall be stored on dunnage not touching the ground.

D. Coordinate erection aid requirements with contractor/Owner.

3.3 ERECTION

A. Braces are to be erected under the Structural Steel Specification Section and according to referenced AISC Specifications.

B. Prior to erection, clean faying surfaces of BRB to be in contact with bolted connections to remove temporary coatings applied for transport and surface contaminants.

C. Manufacturer shall coordinate with Owner's Representative to verify proper BRB dimensions.

D. Allow for erection loads and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of buckling-restrained braces.

E. No field welding to BRB's is allowed, including non-structural pieces unless approved by manufacturer and Engineer of Record (EOR).

F. No field cutting or altering is permitted without the approval of the manufacturer and EOR.

End of Section

SECTION 053000 - METAL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal decking.
2. Shear connectors.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 01 45 23 - Testing and Inspection.
3. Section 05 12 00 - Structural Steel Framing.

1.2 REFERENCES

A. ASTM A108 – Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.

B. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.

D. ASTM D1056 - Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber.

E. AWS D1.3 – Structural Welding Code Sheet – Steel.

F. AISI – Specifications for the Design of Cold-Formed Steel Structural Members.

1.3 PERFORMANCE REQUIREMENTS

A. Compute properties of deck sections on basis of effective design width as limited by provisions of the AISI specifications. Provide no less than deck section properties specified, including section modulus and moment of inertia per foot of width.

B. Regulatory Requirements:

1. Requirements of Regulatory Agencies: DSA and Underwriters Laboratories Inc. (UL) approval for the decking when installed as a part of an assembly indicated on Drawings in which fire resistive construction ratings are required.
2. Work of this section shall be in accordance with CBC.

C. Manufacturers shall be members of Steel Deck Institute (SDI).

1.4 SUBMITTALS

A. Shop Drawings: Drawings, sections and details indicate type of decking, location, finish, gage of metal, arrangement of sheets, necessary fabrication to incorporate decking into the Work, and relationship to openings and flashing.

1.5 QUALITY ASSURANCE

A. General: Metal decking steel shall conform to requirements of strengths and properties of standards specified.

B. Qualifications of Welders: Properly certified for the type of Work involved in compliance with CBC requirements.

C. Continuous inspection of welding will be performed by a special inspector, approved by DSA to inspect the Work of this section. Refer to Section 01 4523 - Testing and Inspection. The Project Inspector shall be responsible for monitoring the work of the special inspector to ensure that the inspection program is satisfactorily completed.

D. Identification of metal decking steel shall conform to the standards specified in Section 01 4523 - Testing and Inspection.

1. Fabricator shall furnish sufficient evidence to the Architect attesting compliance with specified requirements.

2. Conform to CBC requirements. Unclassified or unidentified decking is not permitted. Furnish deck manufacturer's certified mill analyses and test reports for each heat covering decking having a minimum Fy of 33 Ksi. In addition, for decking having F_y greater than 33 Ksi, testing laboratory shall perform one tension and elongation test and one bend or flattening test for each gage.

E. Unidentifiable Steel: Steel which is not readily identifiable as to grade from markings and test records is not permitted to be provided as part of the Work of this section.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. ASC Steel Deck.

B. Verco Manufacturing Co.

C. Epic Metals Corporation.

D. Equal.

2.2 MATERIALS

A. Metal Decking: Roll-formed sheets conforming to ASTM A653, with G90 zinc coating.

1. Section properties shall conform to applicable provisions of latest edition of AISI - Specification for the Design of Cold-Formed Steel Structural Members.

B. Flexible Closure Strips for Deck: Vulcanized, closed-cell, expanded chloroprene elastomer, complying with ASTM D1056, Grade SCE #41.

1. Brittleness Temperature: Minus 40 degrees F, ASTM D746.

2. Flammability Resistance: Self-extinguishing,

C. Metal Flashing and Closures: 22 gage minimum, with ASTM A653, G90 zinc coating.

D. Shear Connectors: Headed stud type, ASTM A108 Grade 1015, cold-finished carbon steel complying with AISC specifications.

2.3 FABRICATION

A. Corrugated sheets or sections shall be designed to support required live load between supporting members.

B. Provide decking in lengths to span over three or more supports.

C. Except as detailed otherwise, provide decking with interlocking side laps, 2 ½-inch minimum end bearing, and 1 ½-inch minimum side bearing.

D. Welding: Provide materials and methods in accordance with recommendations of steel decking manufacturer and reviewed submittals. Hold decking tight to the supporting elements with screws or other means for proper welding or crimping of the decking edges. Conform to AWS D1.3, and to the patterns and weld types indicated, with welds free from sharp edges and protrusions. Field coat welds and abraded surfaces at completion with an anodic type galvanizing repair paint. Omit the field paint coating where welds or abrasions are covered by concrete fill or sprayed fireproofing.

PART 3 - EXECUTION

3.1 OPENINGS

A. Cut and reinforce units to provide openings which are located and dimensioned on the structural and mechanical Drawings.

B. Provide openings, or other Work not indicated on the Drawings.

3.2 INSTALLATION

A. Install metal decking in accordance with decking manufacturers' recommendations, requirements of Drawings, Shop Drawings, and Specifications.

B. Install metal decking on supporting steel framework and adjust to final position before permanently fastening in place.

1. Install each unit to proper bearing on supports.

2. Install units in straight alignment for entire length of run of cells with close registration of cells of one unit with those of abutting unit.

C. Fasten decking to steel framework at ends of units and at intermediate supports. Welding shall be as indicated on Drawings.

D. Fasten side laps between supports as indicated on Drawings.

E. Perform field cutting parallel with cells in area between cells, leaving sufficient horizontal material to permit welding to support steel.

F. Weld shear connectors to supports thru decking units as required by Drawings. Weld only on clean, dry surfaces. Do not weld shear connectors thru two layers of decking units.

3.3 METAL FLASHINGS AND CLOSURES

A. Furnish, install, and weld in position, sheet metal closure flashing, closure angles, closure plates, profile plates, and shear plates.

B. Close open ends of cell runs at columns, openings, walls, similar interruptions and termination.

3.4 FIELD QUALITY CONTROL

A. Inspection: Install steel decking under continuous inspection according to CBC Chapter 1704A.3.

1. Welding inspection for steel deck diaphragms shall conform to CBC Section 2204A.1.

3.5 CLEAN UP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.6 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Exterior load-bearing wall framing.

B. Interior load-bearing wall framing.

C. Exterior non-load-bearing, curtain-wall framing.

D. Floor joist framing.

E. Roof trusses.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads without deflections greater than the following:

1. Retain or insert deflection limits appropriate for wall, floor, and ceiling finish materials.
2. Exterior Load-Bearing Wall Framing: Horizontal deflection of L/240 of the wall height.
3. Interior Load-Bearing Wall Framing: Horizontal deflection of L/240 of the wall height.
4. Exterior Non-Load-Bearing, Curtain-Wall Framing: Horizontal deflection of L/360 of the wall height. When supporting brick veneer, max horizontal deflection shall be limited to L/600.

1.3 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Include layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners.

1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Mill certificates.

D. Welder certificates.

E. Research/evaluation reports.

1.4 QUALITY ASSURANCE

A. Comply with AISI's "Specification for the Design of Cold-Formed Steel Structural Members" for calculating structural characteristics of cold-formed metal framing.Retain subparagraph below with "Performance Requirements" Article.

1. Engineering Responsibility: Engage a qualified professional engineer to prepare design calculations, Shop Drawings, and other structural data.

B. Mill certificates signed by steel sheet producer

C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

D. Fire-Test-Response Characteristics: Where metal framing is part of a fire-resistance-rated assembly, provide framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing agency acceptable to authorities having jurisdiction.

2. Fire-Resistance Ratings: Indicated by GA File Numbers in GA-600, "Fire Resistance Design Manual," or by design designations from UL's "Fire Resistance Directory" or from the listings of another testing agency.

E. Comply with HUD's "Prescriptive Method for Residential Cold-Formed Steel Framing."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Allied American Studco, Inc.
2. Angeles Metal Systems.
3. California Expanded Metal Products Co.
4. California Metal Systems, Inc.
5. Clark Steel Framing Industries.
6. Consolidated Fabricators Corp.

7. Consolidated Systems, Inc.
8. Dale Industries, Inc.
9. Design Shapes in Steel.
10. Dietrich Industries, Inc.
11. Knorr Steel Framing Systems.
12. MarinoWare; Div. of Ware Industries, Inc.
13. Scafco Corp.
14. Steel Construction Systems.
15. Steel Developers, LLC.
16. Steeler, Inc.
17. Studco of Hawaii, Inc.
18. Super Stud Building Products, Inc.
19. Unimast, Inc.
20. United Metal Products, Inc.
21. Western Metal Lath.

2.2 MATERIALS

A. Steel Sheet: ASTM A 653/A 653M, structural steel, G60 (Z180) zinc coating, Grade 33 for minimum uncoated steel thickness of 0.0428 inch and less; Grade 50 for minimum uncoated steel thickness of 0.0538 inch and greater.

B. Wall Framing: Manufacturer's standard steel studs, of web depths indicated, with stiffened flanges, complying with ASTM C 955.

C. Joist Framing: Manufacturer's standard C-shaped steel joists, of web depths indicated, [unpunched] [punched], with stiffened flanges, complying with ASTM C 955..

D. Roof Truss Members: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges, complying with ASTM C 955, of minimum uncoated-steel thickness and flange width indicated on Shop Drawings.

2.3 ACCESSORIES AND MISCELLANEOUS MATERIALS

A. Fabricate steel-framing accessories of the same material and finish used for framing members, with a minimum yield strength of 33,000 psi, of manufacturer's standard thickness and configuration, unless otherwise indicated.

B. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123.

C. Anchor Bolts: ASTM F 1554, Grade 55, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

D. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

E. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

F. Mechanical Fasteners: Corrosion-resistant-coated, self-drilling, self-threading steel drill screws.

G. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

H. Retain below if insulation of inaccessible voids within cold-formed steel framing is required.

I. Thermal Insulation: ASTM C 665, Type I, unfaced mineral-fiber blankets produced by combining glass or slag fibers with thermosetting resins.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Preparation: Grout bearing surfaces uniform and level to ensure full contact of bearing flanges or track webs on supporting concrete or masonry construction. contact of bearing flanges or track webs on supporting concrete or masonry construction.

B. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to ASTM C 1007, manufacturer's written recommendations, and requirements in this Section.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
3. Install framing members in one-piece lengths.
4. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed.
5. Install insulation in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

6. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

C. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

D. Load-Bearing Wall Installation: Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends. Squarely seat studs against webs of top and bottom tracks. Space studs as indicated, set plumb, align, and fasten both flanges of studs to top and bottom tracks.

1. Align studs vertically where wall-framing continuity is interrupted by floor framing. Where studs cannot be aligned, continuously reinforce track to transfer loads.
2. Align floor and roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads.
3. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.
4. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
5. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings.
6. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
7. Install horizontal bridging in stud system, spaced as indicated on Shop Drawings. Fasten at each stud intersection.
8. Install miscellaneous framing and connections, including supplementary framing, blocking, bracing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

E. Non-Load-Bearing, Curtain-Wall Installation: Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure. Space studs as indicated; set plumb, align, and fasten both flanges of studs to track, unless otherwise indicated.

1. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
2. Install horizontal bridging in curtain-wall studs, spaced in rows indicated on Shop Drawings but not more than 54 inches apart. Fasten at each stud intersection.
3. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable curtain-wall-framing system.

F. Joist Installation: Install, align, and securely anchor perimeter joist track sized to match joists as indicated on Shop Drawings. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten to both flanges of joist track.

1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches. Reinforce ends and bearing points of joists as indicated on Shop Drawings.
2. Space joists not more than 2 inches from abutting walls and at spacings indicated.
3. Frame openings with built-up joist headers consisting of joist and joist track, nesting joists, or another combination of connected joists if indicated.
4. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated. Install web stiffeners to transfer axial loads of walls above.
5. Install bridging at each end of joists and at intervals indicated. Fasten bridging at each joist intersection as indicated.
6. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.
7. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

G. Retain first paragraph and subparagraphs below if roof trusses are required.

H. Truss Installation: Install, bridge, and brace trusses according to Shop Drawings. Do not alter, cut, or remove framing members or connections of trusses.

1. Erect trusses with plane of truss webs plumb and parallel to each other, align, and accurately position at spacings indicated.
2. Erect trusses without damaging framing members or connections.
3. Align webs of bottom chords and load-bearing studs or continuously reinforce track to transfer loads to structure. Anchor trusses securely at all bearing points.
4. Install continuous bridging and permanently brace trusses as indicated.

I. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

3.2 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing agency to perform field quality-control testing.

1. Field and shop welds will be subject to testing and inspection.
2. Remove and replace Work that does not comply with specified requirements.
3. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

END OF SECTION 05 40 00

This page intentionally left blank.

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Steel framing and supports for operable partitions.
2. Steel framing and supports for countertops.
3. Steel tube reinforcement for low partitions.
4. Steel framing and supports for mechanical and electrical equipment.
5. Steel framing and supports for mechanical equipment screens.
6. Steel framing and supports for applications where framing and supports are not specified in other Sections.
7. Elevator machine beams.
8. Steel shapes for supporting elevator door sills.
9. Shelf angles.
10. Metal ladders.
11. Metal bollards.
12. Abrasive metal nosings.
13. Loose bearing and leveling plates for applications where they are not specified in other Sections.
14. Metal Fence and Gate at Stair Roof.
15. Metal Panels and Gate at Poetry Yard CMU Wall.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Section 042113.13 "Brick Veneer Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
3. Section 051200 "Structural Steel Framing" for steel framing, supports, elevator machine beams, hoist beams, divider beams, door frames, and other steel items attached to the structural-steel framing.
4. Section 055113 "Metal Pan Stairs."
5. Section 055213 "Pipe and Tube Railings."

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Shop primers.
3. Shrinkage-resisting grout.
4. Abrasive metal nosings.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

1. Steel framing and supports for operable partitions.
2. Steel framing and supports for countertops.
3. Steel tube reinforcement for low partitions.
4. Steel framing and supports for mechanical and electrical equipment.
5. Steel framing and supports for mechanical equipment screens.
6. Steel framing and supports for applications where framing and supports are not specified in other Sections.
7. Elevator machine beams.
8. Steel shapes for supporting elevator door sills.
9. Shelf angles.
10. Metal ladders.
11. Metal bollards.
12. Metal Fence and Gate at Stair Roof.
13. Metal Panels and Gate at Poetry Yard CMU Wall.

C. Samples for Verification: For each type and finish of extruded nosing.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

C. Research Reports: For post-installed anchors.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 ACCESSIBILITY REQUIREMENTS

A. Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

B. Doors, Doorways, and Gates:

1. General: Doors, doorways, and gates that are part of an accessible route shall comply with CBC Section 11B-404 per CBC Section 11B-404.1.

a. Exceptions:

1) Doors, doorways, and gates designed to be operated only by security personnel shall not be required to comply with CBC Sections 11B-404.2.7, 11B-404.2.8, 11B-4042.9, 11B-404.3.2, and 11B-404.3.4 through 11B-404.3.7. A sign visible from the approach side complying with CBC Section 11B-703.5 shall be posted stating "ENTRY RESTRICTED AND CONTROLLED BY SECURITY PERSONNEL."
2) At detention and correctional facilities, doors, doorways, and gates designed to be operated only by security personnel shall not be required to comply with CBC Sections 11B-404.2.7, 11B-404.2.8, 11B-4042.9, 11B-404.3.2, and 11B-404.3.4 through 11B-404.3.7.

2. Manual Doors, Doorways, and Manual Gates: Manual doors and doorways and manual gates intended for user passage shall comply with CBC Section 11B-404.2 per CBC Section 11B-404.2.

a. Revolving Doors, Gates, and Turnstiles: Revolving doors, revolving gates, and turnstiles shall not be part of an accessible route per CBC Section 11B-404.2.1.
b. Double-Leaf Doors and Gates: At least one of the active leaves of doorways with two leaves shall comply with CBC Sections 11B-404.2.3 and 11B-404.2.4 per CBC Section 11B-404.2.2.
c. Clear Width: Openings shall provide a clear width of 32 inches (813 mm) minimum. Clear openings of doorways with swinging doors shall be measured between the face of the door and the stop, with the door open 90 degrees. Openings more than 24 inches (610 mm) deep shall provide a clear opening of 36 inches (914 mm) minimum. There shall be no projections into the required clear opening width lower than 34 inches (864 mm) above the finish floor or ground. Projections into the clear opening width between 34 inches (864 mm) and 80 inches (2032 mm) above the finish floor or ground shall not exceed 4 inches (102 mm) per CBC Section 11B-404.2.3 and CBC Figure 11B-404.2.3.

1) Exceptions:

a) In alterations, a projection of 5/8 inch (15.9 mm) maximum into the required clear width shall be permitted for the latch side stop.
b) Door closers and door stops shall be permitted to be 78 inches (1981 mm) minimum above the finish floor or ground.

d. Maneuvering Clearances: Minimum maneuvering clearances at doors and gates shall comply with CBC Section 11B-404.2.4. Maneuvering clearances shall extend the full width of the doorway and the required latch side or hinge side clearance per CBC Section 11B-404.2.4.

1) Swinging Doors and Gates: Swinging doors and gates shall have maneuvering clearances complying with CBC Table 11B-404.2.4.1 per CBC Section 11B-404.2.4.1.
2) Doorways Without Doors or Gates, Sliding Doors, and Folding Doors: Doorways less than 36 inches (914 mm) wide without doors or gates, sliding doors, or folding doors shall have maneuvering clearances complying with CBC Table 11B-404.2.4.2 per CBC Section 11B-404.2.4.2.
3) Recessed Doors and Gates: Maneuvering clearances for forward approach shall be provided when any obstruction within 18 inches (457 mm) of the latch side at an interior doorway, or within 24 inches (610 mm) of the latch side of an exterior doorway, projects more than 8 inches (203 mm) beyond the face of the door, measured perpendicular to the face of the door or gate per CBC Section 11B-404.2.4.3.
4) Floor or Ground Surface: Floor or ground surface within required maneuvering clearances shall comply with CBC Section 11B-302. Changes in level are not permitted per CBC Section 11B-404.2.4.4.

a) Exception:

1. Slopes not steeper than 1:48 shall be permitted.
2. Changes in level at thresholds complying with CBC Section 11B-404.2.5 shall be permitted.

e. Thresholds: Thresholds, if provided at doorways, shall be 1/2 inch (12.7 mm) high maximum. Raised thresholds and changes in level at doorways shall comply with CBC Sections 11B-302 and 11B-303 per CBC Section 11B-404.2.5.
f. Doors in a Series and Gates in a Series: The distance between two hinged or pivoted doors in series and gates in series shall be 48 inches (1219 mm) minimum plus the width of the doors or gates swinging into the space per CBC Section 11B-404.2.6.
g. Door and Gate Hardware: Handles, pulls, latches, locks, and other operable parts on doors and gates shall comply with CBC Section 11B-309.4. Operable parts of such hardware shall be 34 inches (864 mm) minimum and 44 inches (1118 mm) maximum above the finish floor or ground. Where sliding doors are in the fully open position, operating hardware shall be exposed and usable from both sides per CBC Section 11B-404.2.7.

1) Exceptions:

a) Existing locks shall be permitted in any location at existing glazed doors without stiles, existing overhead rolling doors or grilles, and similar existing doors or grilles that are designed with locks that are activated only at the top or bottom rail.
b) Access gates in barrier walls and fences protecting pools, spas, and hot tubs shall be permitted to have operable parts of the release latch on self-latching devices at

54 inches (1372 mm) maximum above the finish floor or ground provided the self-latching devices are not also self-locking devices and operated by means of a key, electronic opener, or integral combination lock.

2) Operation: Operable parts shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate operable parts shall be 5 pounds (22.2 N) maximum per CBC Section 11B-309.4.

h. Closing Speed: Door and gate closing speed shall comply with CBC Section 11B-404.2.8 per CBC Section 11B-404.2.8.

1) Door Closers and Gate Closers: Door closers and gate closers shall be adjusted so that from an open position of 90 degrees, the time required to move the door to a position of 12 degrees from the latch is 5 seconds minimum per CBC Section 11B-404.2.8.1.
2) Spring Hinges: Door and gate spring hinges shall be adjusted so that from the open position of 70 degrees, the door or gate shall move to the closed position in 1.5 seconds minimum per CBC Section 11B-404.2.8.2.

i. Door and Gate Opening Force: The force for pushing or pulling open a door or gate shall be as follows per CBC Section 11B-404.2.9:

1) Interior Hinged Doors and Gates: 5 pounds (22.2 N) maximum.
2) Sliding or Folding Doors: 5 pounds (22.2 N) maximum.
3) Required Fire Doors: The minimum opening force allowable by the appropriate administrative authority, not to exceed 15 pounds (66.7 N).
4) Exterior Hinged Doors: 5 pounds (22.2 N) maximum.
5) These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door or gate in a closed position.
6) Operation: Operable parts shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate operable parts shall be 5 pounds (22.2 N) maximum per CBC Section 11B-309.4.
7) Door Opening Force: The force for pushing or pulling open interior swinging egress doors, other than fire doors, shall not exceed 5 pounds (22.2 N). These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position. For other swinging doors, as well as sliding and folding doors, the door latch shall release when subjected to a 15 pound (67 N) force. The door shall be set in motion when subjected to a 30 pound (133 N) force. The door shall swing to a full-open position when subjected to a 15 pound (67 N) force per CBC Section 1010.1.3.

a) Location of Applied Forces: Forces shall be applied to the latch side of the door per CBC Section 1010.1.3.1.

j. Door and Gate Surfaces: Swinging door and gate surfaces within 10 inches (254 mm) of the finish floor or ground measured vertically shall have a smooth surface on the push side extending the full width of the door or gate. Parts creating horizontal or vertical joints in these surfaces shall be within 1/16 inch (1.6 mm) of the same plane as the other and be free of sharp or abrasive edges. Cavities created by added kick plates shall be capped per CBC Section 11B-404.2.10.

1) Exceptions:

a) Sliding doors shall not be required to comply with CBC Section 11B-404.2.10.

b) Tempered glass doors without stiles and having a bottom rail or shoe with the top leading edge tapered at 60 degrees minimum from the horizontal shall not be required to meet the 10 inch (254 mm) bottom smooth surface height requirement.

c) Doors and gates that do not extend to within 10 inches (254 mm) of the finish floor or ground shall not be required to comply with CBC Section 11B-404.2.10.

k. Vision Lights (Lites): Doors, gates, and side lights (lites) adjacent to doors or gates, containing one or more glazing panels that permit viewing through the panels shall have the bottom of at least one glazed panel located 43 inches (1092 mm) maximum above the finish floor per CBC Section 11B-404.2.11.

1) Exception: Glazing panels with the lowest part more than 66 inches (1676 mm) from the finish floor or ground shall not be required to comply with CBC Section 11B-404.2.11.

C. Stairways:

1. General: Interior and exterior stairs shall comply with CBC Section 11B-504 per CBC Section 11B-210.1.

D. Stairways:

1. General: Stairs shall comply with CBC Section 11B-504 per CBC Section 11B-504.1.

a. Contrasting Stripe: Interior stairs shall have the upper approach and lower tread marked by a stripe providing clear visual contrast. Exterior stairs shall have the upper approach and all treads marked by a stripe providing clear visual contrast per CBC Section 11B-504.4.1.

1) The stripe shall be a minimum of 2 inches (51 mm) wide to a maximum of 4 inches (102 mm) wide placed parallel to, and not more than 1 inch (25 mm) from, the nose of the step or upper approach. The stripe shall extend the full width of the step or upper approach and shall be of material that is at least as slip resistant as the other treads of the stair. A painted stripe shall be acceptable. Grooves shall not be used to satisfy this requirement.

2. Nosings: The radius of the curvature at the leading edge of the tread shall be 1/2 inch (12.7 mm) maximum. Nosings that project beyond risers shall have the underside of the leading edge curved or beveled. Risers shall be permitted to slope under the tread at an angle of 30 degrees maximum from vertical. The permitted projection of the nosing shall extend 1-1/4 inches (32 mm) maximum over the tread below per CBC Section 11B-504.5.

a. Exception: In existing buildings there is no requirement to retroactively alter existing nosing projections of 1-1/2 inches (38 mm) which were constructed in compliance with the building code in effect at the time of original construction.

2.2 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.3 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Recycled Content of Steel Products: Recycled content not less than 20 percent.

C. Recycled Content of Aluminum Products: Recycled content not less than 20 percent.

D. Low-Emitting Materials: Paints and coatings shall comply with the requirements of authorities having jurisdiction.

2.4 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

D. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

E. Woven-Wire Mesh: Intermediate-crimp, square pattern, woven-wire mesh.

1. Basis-of-Design Product: Subject to compliance with requirements, provide McNichols; Quality Decorative Mesh, Designer Series, Copper, Techna, 8169 Plus, 48 inches by 96 inches, Item Number 3381690048, or comparable product by another manufacturer.

F. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.

1. Size of Channels: 1-5/8 by 1-5/8 inches (41 by 41 mm) unless otherwise indicated.
2. Material: Provide one of the following:

a. Galvanized steel, ASTM A653/A653M, structural steel, Grade 33 (Grade 230), with G90 (Z275) coating; not less than 0.0762 inch (1.94 mm) thick (14 gage nominal).
b. Cold-rolled steel, ASTM A1008/A1008M, structural steel, Grade 33 (Grade 230); not less than 0.0747 inch (1.90 mm) thick (14 gage nominal); hot-dip galvanized after fabrication.

G. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063-T6.

2.5 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless steel fasteners for fastening aluminum.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A (ASTM F568M, Property Class 4.6); with hex nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.

C. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593 (ASTM F738M); with hex nuts, ASTM F594 (ASTM F836M); and, where indicated, flat washers; Alloy Group 1 (A1).

D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

E. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.

F. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.

G. Post-Installed Anchors: Torque-controlled expansion anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless steel bolts, ASTM F593 (ASTM F738M), and nuts, ASTM F594 (ASTM F836M).

H. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches (41 by 22 mm) by length indicated with anchor straps or studs not less than 3 inches (75 mm) long at not more than 8 inches (200 mm) o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

2.6 MISCELLANEOUS MATERIALS

A. Welding Electrodes: Comply with AWS requirements.

B. Zinc-Rich Primer:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Tnemec Company, Inc.; Series 94-H2O Hydro-Zinc, or comparable product by another manufacturer.

a. Apply at a dry film thickness of not less than 2.5 to 3.5 mils (0.0635 to 0.0889 mm).

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

E. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).

2.7 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible.

1. Disassemble units only as necessary for shipping and handling limitations.
2. Use connections that maintain structural value of joined pieces.
3. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Weld exposed corners and seams continuously unless otherwise indicated.
5. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

    a. Finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 - No evidence of welded joint.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible.

1. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated.
2. Locate joints where least conspicuous.
3. Fabricate joints, seams, and other connections that will be exposed to weather in a manner to exclude water.
4. Provide weep holes where water may accumulate.

G. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

H. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

I. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with not less than 6 inch (150 mm) embedment and 2 inch (50 mm) hook, not more than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.8 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.

C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated or, if not indicated, sizes recommended by partition manufacturer with attached bearing plates, anchors, and braces as indicated or, if not indicated, as recommended by partition manufacturer. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Galvanize exterior miscellaneous framing and supports and prime with zinc-rich primer.

E. Galvanize miscellaneous framing and supports where indicated and prime with zinc-rich primer.

F. Prime miscellaneous framing and supports with zinc-rich primer unless otherwise indicated.

2.9 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4 inch (19 mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches (50 mm) larger than expansion or control joint.

B. Galvanize shelf angles and prime with zinc-rich primer unless otherwise indicated.

C. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.10 METAL LADDERS

A. General:

1. Comply with ANSI A14.3 unless otherwise indicated.
2. For elevator pit ladders, comply with ASME A17.1/CSA B44.

B. Steel Ladders:

1. Space siderails 16 inches (406 mm) apart unless otherwise indicated.
2. Siderails: Continuous, 3/8 by 2-1/2 inch (9.5 by 64 mm) steel flat bars, with eased edges.
3. Rungs: 3/4 inch (19 mm) diameter or 3/4 inch (19 mm) square, steel bars.
4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. Contractor may provide nonslip surfaces on top of each rung using any method specified below or may submit an alternate method for consideration.

    a. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
    b. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung.

        1) Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

            a) Harsco Industrial IKG, a division of Harsco Corporation; Mebac.
            b) ROSS TECHNOLOGY CORP.; Algrip Slip-Resistant Ladder Rungs - Carbon Steel.
            c) W.S. Molnar Company; SlipNOT Ladder Rungs.

    c. Source Limitations: Obtain nonslip surfaces from single source from single manufacturer.

6. Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted steel brackets.

C. Galvanize exterior steel ladders, including brackets and fasteners, and prime with zinc-rich primer.

D. Galvanize steel ladders, including brackets and fasteners, where indicated, and prime with zinc-rich primer.

E. Prime steel ladders, including brackets and fasteners, with zinc-rich primer unless otherwise indicated.

2.11 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 40 steel pipe or 1/4 inch (6.4 mm) wall-thickness rectangular steel tubing unless otherwise indicated.

1. Cap removable bollards with 1/4 inch (6.4 mm) thick, steel plate with flat top and rounded edges.

B. Fabricate sleeves for removable bollards from Schedule 40 steel pipe or 1/4 inch (6.4 mm) wall-thickness rectangular steel tubing with an ID approximately 1/4 inch (6.4 mm) greater than OD of bollards, with metal plate forming bottom closure.

1. Provide locking tabs on removable bollards unless otherwise indicated.
2. Provide key box where indicated on Drawings.

C. Galvanize exterior steel bollards and prime with zinc-rich primer.

D. Galvanize steel bollards where indicated, and prime with zinc-rich primer.

E. Prime steel bollards with zinc-rich primer unless otherwise indicated.

2.12 ABRASIVE METAL NOSINGS

A. Extruded Units: Aluminum, with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Balco, Inc; XH-330, or a comparable product by one of the following:

    a. American Safety Tread Co., Inc.
    b. Amstep Products.
    c. Armstrong Products, Inc.
    d. Nystrom, Inc.
    e. Upnovr, Inc.
    f. Wooster Products Inc.

2. Source Limitations: Obtain units from single source from single manufacturer.
3. Provide solid-abrasive-type units without ribs.
4. Nosings: Two-piece units, not less than 3 inches (75 mm) wide, with subchannel for casting into concrete steps.

    a. Provide abrasive metal nosings at the upper approach and all treads unless otherwise indicated.
    b. Abrasive metal nosings shall provide clear visual contrast.
    c. Abrasive metal nosings shall be not less than 2 inches (51 mm) wide and not more than 4 inches (102 mm) wide placed parallel to, and not more than 1 inch (25 mm) from, the nose of the step or upper approach.
    d. Abrasive metal nosings shall extend the full width of the step or upper approach and shall be of material that is at least as slip resistant as the other treads of the stair.
    e. Abrasive metal nosings color shall contrast with the stair tread color in compliance with accessibility requirements of authorities having jurisdiction.

B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

C. Apply clear lacquer to concealed surfaces of extruded units.

2.13 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize exterior loose bearing and leveling plates and prime with zinc-rich primer.

C. Galvanize loose bearing and leveling plates where indicated and prime with zinc-rich primer.

D. Prime loose bearing and leveling plates with zinc-rich primer unless otherwise indicated.

2.14 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches (200 mm) unless otherwise indicated.

C. Galvanize exterior loose steel lintels and prime with zinc-rich primer.

D. Galvanize loose steel lintels where indicated and prime with zinc-rich primer.

E. Prime loose steel lintels with zinc-rich primer unless otherwise indicated.

2.15 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.16 METAL FENCE AND GATE AT STAIR ROOF

A. Unless otherwise indicated, fabricate units from steel tubes, shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

1. Fabricate metal fence and gate at stair roof using woven-wire mesh.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

C. Provide hardware for gates as indicated on Drawings, or if not indicated, as necessary for proper and reliable operation, including but not limited to hinges, cane bolts and hasps for padlocks.

1. Hardware Preparation: Prepare gates to receive hardware included in the Door Hardware Schedule.

D. Galvanize metal fences, gates, and hardware and prime with zinc-rich primer.

2.17 METAL PANELS AND GATE AT POETRY YARD CMU WALL

A. Unless otherwise indicated, fabricate units from steel tubes, shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

1. Fabricate metal panels and gate at poetry yard CMU wall using aluminum blade infill.

a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or a comparable product by another manufacturer.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction or anchors as indicated on Drawings.

C. Provide hardware for gates as indicated on Drawings, or if not indicated, as necessary for proper and reliable operation, including but not limited to hinges, cane bolts and hasps for padlocks.

1. Hardware Preparation: Prepare gates to receive hardware included in the Door Hardware Schedule.

D. Galvanize metal panels, gates, and hardware and prime with zinc-rich primer.

2.18 METAL GATES AND HARDWARE AT TRASH ENCLOSURE

A. Unless otherwise indicated, fabricate units from steel tubes, shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

1. Fabricate metal gates using metal deck.

a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or a comparable product by another manufacturer.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction or anchors as indicated on Drawings.

C. Provide hardware for gates as indicated on Drawings, or if not indicated, as necessary for proper and reliable operation, including but not limited to hinges, cane bolts and hasps for padlocks.

D. Galvanize metal gates and hardware after fabrication.

2.19 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.20 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Shop prime iron and steel items unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

C. Preparation for Shop Priming Galvanized Items: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

1. SSPC-SP 1, "Solvent Cleaning" to remove all soluble contamination. Thoroughly roughen the entire surface to be coated using compressed air nozzle brush off blast cleaning with a fine abrasive to achieve a uniform anchor profile of 1.0 to 2.0 mils (0.0254 to 0.0508 mm). Reference ASTM D 6386, Section 5.4.1.

D. Preparation for Shop Priming: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:

1. Shop: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

F. Preparation for Field Priming: Clean field welds, bolted connections, and areas where shop primer is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

1. SSPC-SP 11, "Power Tool Cleaning to Bare Metal" all welds and damaged zinc-rich primer.

2.21 ALUMINUM FINISHES

A. As-Fabricated Finish (Mill Finish): AA-M12.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to, and rigidly brace from, building structure.

C. Anchor shelf angles securely to existing construction with expansion anchors, anchor bolts, or through bolts as indicated on Drawings.

3.3 INSTALLATION OF METAL BOLLARDS

A. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches (75 mm) above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

B. Anchor sleeves for removable bollards in place with concrete footings. Center and align sleeves in holes 3 inches (75 mm) above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace sleeves in position until concrete has cured.

C. Place removable bollards in sleeves. Align locking tabs prior to inserting padlocks. Owner furnishes padlocks.

D. Fill bollards solidly with concrete, mounding top surface to shed water.

1. Do not fill removable bollards with concrete.

3.4 INSTALLATION OF NOSINGS

A. Center nosings on tread widths unless otherwise indicated.

B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.

3.5 INSTALLATION OF BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with shrinkage-resistant grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.6 INSTALLATION OF METAL FENCE AND GATE AT STAIR ROOF

A. General: Install metal fences, gates, and hardware to comply with requirements of items being supported, including requirements indicated on Shop Drawings.

B. Adjust gates for smooth and proper operation. Adjust hardware for smooth and proper operation. Lubricate hardware according to manufacturer’s recommendations.

3.7 INSTALLATION OF METAL PANELS AND GATE AT POETRY YARD CMU WALL

A. General: Install metal panels, gates, and hardware to comply with requirements of items being supported, including requirements indicated on Shop Drawings.

B. Adjust gates for smooth and proper operation. Adjust hardware for smooth and proper operation. Lubricate hardware according to manufacturer’s recommendations.

3.8 REPAIRS

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

a. Apply by brush or spray to provide a dry film thickness of not less than 2.5 mils (0.0635 mm).

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055000

This page intentionally left blank.

SECTION 055113 - METAL PAN STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Preassembled steel stairs with concrete-filled treads.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for concrete fill for stair treads and platforms.
2. Section 055000 "Metal Fabrications" for abrasive metal nosings installed at locations other than in metal stairs.
3. Section 055213 "Pipe and Tube Railings" for pipe and tube railings.
4. Section 057300 "Decorative Metal Railings" for decorative metal railings.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for metal stairs.

1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.
2. Deliver such items to Project site in time for installation.

C. Coordinate locations of hanger rods and struts with other work so they do not encroach on required stair width and are within fire-resistance-rated stair enclosure.

1.4 ACTION SUBMITTALS

A. Product Data: For metal pan stairs and the following:

1. Abrasive nosings.
2. Shop primer products.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.
2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
3. Include plan at each level.

C. Samples for Verification: For each type and finish of abrasive nosing.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification.

1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
2. Protect steel members and packaged materials from corrosion and deterioration.
3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.

a. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 ACCESSIBILITY REQUIREMENTS

A. Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

B. Stairways:

1. General: Interior and exterior stairs shall comply with CBC Section 11B-504 per CBC Section 11B-210.1.

C. Stairways:

1. General: Stairs shall comply with CBC Section 11B-504 per CBC Section 11B-504.1.

2. Treads and Risers: All steps on a flight of stairs shall have uniform riser heights and uniform tread depths. Risers shall be 4 inches (102 mm) high minimum and 7 inches (178 mm) high maximum. Treads shall be 11 inches (279 mm) deep minimum per CBC Section 11B-504.2.

    a. Exception: Curved stairways with winder treads are permitted at stairs which are not part of a required means of egress.

3. Open Risers: Open Risers are not permitted per CBC Section 11B-504.3.

    a. Exceptions:

        1) On exterior stairways, an opening of not more than 1/2 inch (12.7 mm) may be permitted between the base of the riser and the tread.
        2) On exterior stairways, risers constructed of grating containing openings of not more than 1/2 inch (12.7 mm) may be permitted.

4. Tread Surface: Stair treads shall comply with CBC Section 11B-302. Changes in level are not permitted per CBC Section 11B-504.4.

    a. Exception: Treads shall be permitted to have a slope not steeper than 1:48.
    b. Contrasting Stripe: Interior stairs shall have the upper approach and lower tread marked by a stripe providing clear visual contrast. Exterior stairs shall have the upper approach and all treads marked by a stripe providing clear visual contrast per CBC Section 11B-504.4.1.

        1) The stripe shall be a minimum of 2 inches (51 mm) wide to a maximum of 4 inches (102 mm) wide placed parallel to, and not more than 1 inch (25 mm) from, the nose of the step or upper approach. The stripe shall extend the full width of the step or upper approach and shall be of material that is at least as slip resistant as the other treads of the stair. A painted stripe shall be acceptable. Grooves shall not be used to satisfy this requirement.

    c. Floor or Ground Surfaces:

        1) General: Floor and ground surfaces shall be stable, firm, and slip resistant and shall comply with CBC Section 11B-302 per CBC Section 11B-302.1.

5. Nosings: The radius of the curvature at the leading edge of the tread shall be 1/2 inch (12.7 mm) maximum. Nosings that project beyond risers shall have the underside of the leading edge curved or beveled. Risers shall be permitted to slope under the tread at an angle of 30 degrees maximum from vertical. The permitted projection of the nosing shall extend 1-1/4 inches (32 mm) maximum over the tread below per CBC Section 11B-504.5.

    a. Exception: In existing buildings there is no requirement to retroactively alter existing nosing projections of 1-1/2 inches (38 mm) which were constructed in compliance with the building code in effect at the time of original construction.

6. Handrails: Stairs shall have handrails complying with CBC Section 11B-505 per CBC Section 11B-504.6.
7. Wet Conditions: Stair treads and landings subject to wet conditions shall be designed to prevent the accumulation of water per CBC Section 11B-504.7.

2.2 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.3 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Recycled Content of Steel Products: Recycled content not less than 20 percent.

C. Recycled Content of Aluminum Products: Recycled content not less than 20 percent.

D. Low-Emitting Materials: Paints and coatings shall comply with the requirements of authorities having jurisdiction.

2.4 METALS

A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Steel Tubing: ASTM A500/A500M (cold formed) or ASTM A513/A513M.

D. Uncoated, Cold-Rolled Steel Sheet: ASTM A1008/A1008M, structural steel, Grade 25 (Grade 170), unless otherwise indicated on Drawings; exposed.

E. Uncoated, Hot-Rolled Steel Sheet: ASTM A1011/A1011M, structural steel, Grade 30 (Grade 205), unless otherwise indicated on Drawings.

F. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063-T6.

2.5 ABRASIVE NOSINGS

A. Extruded Units: Aluminum units with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Balco, Inc; XH-330, or a comparable product by one of the following:

a. American Safety Tread Co., Inc.
b. Amstep Products.
c. Armstrong Products, Inc.

d. Granite State Casting Co.
e. Nystrom, Inc.
f. Upnovr, Inc.
g. Wooster Products Inc.

2. Source Limitations: Obtain units from single source from single manufacturer.
3. Provide solid-abrasive units without ribs.
4. Nosings: Two-piece units, not less than 3 inches (75 mm) wide, with subchannel for casting into concrete steps.

a. Provide abrasive metal nosings at the upper approach and all treads unless otherwise indicated.
b. Abrasive metal nosings shall provide clear visual contrast.
c. Abrasive metal nosings shall be not less than 2 inches (51 mm) wide and not more than 4 inches (102 mm) wide placed parallel to, and not more than 1 inch (25 mm) from, the nose of the step or upper approach.
d. Abrasive metal nosings shall extend the full width of the step or upper approach and shall be of material that is at least as slip resistant as the other treads of the stair.
e. Abrasive metal nosings color shall contrast with the stair tread color in compliance with accessibility requirements of authorities having jurisdiction.

B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

C. Apply clear lacquer to concealed surfaces of extruded units set into concrete.

2.6 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless steel fasteners for fastening aluminum.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A (ASTM F568M, Property Class 4.6); with hex nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.

C. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

D. Post-Installed Anchors: Torque-controlled expansion anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless steel bolts, ASTM F593 (ASTM F738M), and nuts, ASTM F594 (ASTM F836M).

2.7 MISCELLANEOUS MATERIALS

A. Welding Electrodes: Comply with AWS requirements.

B. Zinc-Rich Primer:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Tnemec Company, Inc.; Series 94-H2O Hydro-Zinc, or comparable product by another manufacturer.

a. Apply at a dry film thickness of not less than 2.5 to 3.5 mils (0.0635 to 0.0889 mm).

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

E. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with minimum 28-day compressive strength of 3000 psi (20 MPa) and maximum aggregate size of 1/2 inch (13 mm) unless otherwise indicated.

F. Plain Steel Welded-Wire Reinforcement: ASTM A1064/A10645M, steel, 6 by 6 inches (152 by 152 mm), W1.4 by W1.4, unless otherwise indicated on Drawings.

G. Reinforcement Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening welded-wire reinforcement in place.

1. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete.

2.8 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding unless otherwise indicated.

B. Shop Assembly: Assemble stairs in shop to greatest extent possible.

1. Disassemble units only as necessary for shipping and handling limitations.
2. Use connections that maintain structural value of joined pieces.
3. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work with accurate angles and surfaces and straight edges.

F. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Weld exposed corners and seams continuously unless otherwise indicated.
5. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

    a. Finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 - No evidence of welded joint.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible.

1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
2. Locate joints where least conspicuous.
3. Fabricate joints, seams, and other connections that will be exposed to weather in a manner to exclude water.
4. Provide weep holes where water may accumulate internally.

2.9 FABRICATION OF STEEL-FRAMED STAIRS

A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Commercial Class, unless more stringent requirements are indicated.

B. Stair Framing:

1. Fabricate stringers of steel plates, steel channels, or steel rectangular tubes as indicated on Drawings.

    a. Stringer Size: As indicated on Drawings.
    b. Provide closures for exposed ends of channel and rectangular tube stringers.
    c. Finish:

        1) Galvanize exterior stairs and prime with zinc-rich primer.
        2) Galvanize stairs where indicated and prime with zinc-rich primer.
        3) Prime stairs with zinc-rich primer unless otherwise indicated.

2. Construct platforms of steel plate, steel channel, or steel rectangular tube headers and miscellaneous framing members as indicated on Drawings.

    a. Provide closures for exposed ends of channel and rectangular tube framing.
    b. Finish:

1) Galvanize exterior stairs and prime with zinc-rich primer.
2) Galvanize stairs where indicated and prime with zinc-rich primer.
3) Prime stairs with zinc-rich primer unless otherwise indicated.

3. Weld stringers to headers unless otherwise indicated; weld framing members to stringers and headers unless otherwise indicated.
4. Where stairs are enclosed by gypsum board shaft-wall assemblies, provide hanger rods or struts to support landings from floor construction above or below.

   a. Locate hanger rods and struts where they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.

C. Metal Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness indicated on Drawings, but not less than 0.0673 inch (1.71 mm) thick.

1. Fabricate treads and landing subplatforms of exterior stairs so finished walking surfaces slope to drain.
2. Steel Sheet: Uncoated, cold-rolled steel sheet unless otherwise indicated.
3. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
4. Attach abrasive nosings to risers.
5. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

   a. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.

2.10 FINISHES

A. Finish metal stairs after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

C. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.

D. Shop prime metal stair components unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

E. Preparation for Shop Priming Galvanized Items: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

1. SSPC-SP 1, "Solvent Cleaning" to remove all soluble contamination. Thoroughly roughen the entire surface to be coated using compressed air nozzle brush off blast cleaning with a fine abrasive to achieve a uniform anchor profile of 1.0 to 2.0 mils (0.0254 to 0.0508 mm). Reference ASTM D 6386, Section 5.4.1.

F. Preparation for Shop Priming: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:

1. Shop: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

G. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

H. Preparation for Field Priming: Clean field welds, bolted connections, and areas where shop primer is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

1. SSPC-SP 11, "Power Tool Cleaning to Bare Metal" all welds and damaged zinc-rich primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLING METAL PAN STAIRS

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.

1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.

1. Grouted Baseplates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates.

a. Clean bottom surface of plates.
b. Set plates for structural members on wedges, shims, or setting nuts.
c. Tighten anchor bolts after supported members have been positioned and plumbed.
d. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
e. Promptly pack grout solidly between bearing surfaces and plates so no voids remain.

1) Neatly finish exposed surfaces; protect grout and allow to cure.

2) Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints.

1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
2. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
3. Comply with requirements for welding in "Fabrication, General" Article.

F. Place and finish concrete fill for treads and platforms to comply with Section 033000 "Cast-in-Place Concrete."

1. Install abrasive nosings with anchors fully embedded in concrete.
2. Center nosings on tread width.

G. Install precast concrete treads with adhesive supplied by manufacturer.

H. Install precast terrazzo treads according to manufacturer's written instructions.

3.3 REPAIR

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

a. Apply by brush or spray to provide a dry film thickness of not less than 2.5 mils (0.0635 mm).

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055113

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Steel pipe and tube railings.

B. Related Requirements:

1. Section 057300 "Decorative Metal Railings" for ornamental railings fabricated from pipes and tubes.
2. Section 092216 "Non-Structural Metal Framing" for metal backing for anchoring railings.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for railings.

1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.
2. Deliver such items to Project site in time for installation.

C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Railing brackets.
2. Grout.
3. Anchoring cement.
4. Shop primer products.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.
2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
3. Include plan at each level.

C. Samples for Verification: For each type of exposed finish required.

1. Fittings and brackets.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

C. Evaluation Reports: For post-installed anchors.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

2.2 ACCESSIBILITY REQUIREMENTS

A. Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

B. Ramps:

1. General: Ramps on accessible routes shall comply with CBC Section 11B-405 per CBC Section 11B-405.1.

    a. Exception: In assembly areas, aisle ramps adjacent to seating and not serving elements required to be on an accessible route shall not be required to comply with CBC Section 11B-405.

2. Handrails: Ramp runs shall have handrails complying with CBC Section 11B-505 per CBC Section 11B-405.8.

    a. Exceptions:

        1) Reserved.
        2) Reserved.
        3) Curb ramps do not require handrails.
        4) At door landings, handrails are not required on ramp runs less than 6 inches (152 mm) in rise or 72 inches (1829 mm) in length.

3. Edge Protection: Edge protection complying with CBC Section 11B-405.9.2 shall be provided on each side of a ramp runs and at each side of ramp landings per CBC Section 11B-405.9.

    a. Exceptions:

        1) Edge protection shall not be required on ramps that are not required to have handrails and have sides complying with CBC Section 11B-406.2.2.
        2) Edge protection shall not be required on the sides of ramp landings serving an adjoining ramp run or stairway.
        3) Edge protection shall not be required on the sides of ramp landings having a vertical drop-off of 1/2 inch (12.7 mm) maximum within 10 inches (254 mm) horizontally of the minimum landing area specified in CBC Section 11B-405.7.

    b. Reserved.
    c. Curb or Barrier: A curb, 2 inches (51 mm) high minimum, or a barrier shall be provided that prevents the passage of a 4 inch (102 mm) diameter sphere, where any portion of the sphere is within 4 inches (102 mm) of the finish floor or ground surface. To prevent wheel entrapment, the curb or barrier shall provide a continuous and uninterrupted barrier along the length of the ramp per CBC Section 11B-405.9.2.

C. Handrails:

1. General: Handrails provided along walking surfaces complying with CBC Section 11B-403, required at ramps complying with CBC Section 11B-405, and required at stairs complying with CBC Section 11B-504 shall comply with CBC Section 11B-505 per CBC Section 11B-505.1.
2. Where Required: Handrails shall be provided on both sides of stairs and ramps per CBC Section 11B-505.2.

    a. Exceptions:

        1) In assembly areas, handrails shall not be required on both sides of aisle ramps where a handrail is provided at either side or within the aisle width.
        2) Curb ramps do not require handrails.
        3) At door landings, handrails are not required when the ramp run is less than 6 inches (152 mm) in rise or 72 inches (1829 mm) in length.

b. Orientation: The orientation of at least one handrail shall be in the direction of the stair run, perpendicular to the direction of the stair nosing, and shall not reduce the minimum required width of the stair per CBC Section 11B-505.2.1.

3. Continuity: Handrails shall be continuous within the full length of each stair flight or ramp run. Inside handrails on switchback or dogleg stairs and ramps shall be continuous between flights or runs per CBC Section 11B-505.3.

   a. Exception: In assembly areas ramp handrails adjacent to seating or within aisle width shall not be required to be continuous in aisles serving seating.

4. Height: Top of gripping surfaces of handrails shall be 34 inches (864 mm) minimum and 38 inches (965 mm) maximum vertically above walking surfaces, stair nosings, and ramp surfaces. Handrails shall be at a consistent height above walking surfaces, stair nosings, and ramp surfaces per CBC Section 11B-505.4 and CBC Figure 11B-505.4.
5. Clearance: Clearance between handrail gripping surfaces and adjacent surfaces shall be 1-1/2 inches (38 mm) minimum. Handrails may be located in a recess if the recess is 3 inches (76 mm) maximum deep and 18 inches (457 mm) minimum clear above the top of the handrail per CBC Section 11B-505.5 and CBC Figure 11B-505.5.
6. Gripping Surface: Handrail gripping surfaces shall be continuous along their length and shall not be obstructed along their tops or sides. The bottoms of handrail gripping surfaces shall not be obstructed for more than 20 percent of their length. Where provided, horizontal projections shall occur 1-1/2 inches (38 mm) minimum below the bottom of the handrail gripping surface per CBC Section 11B-505.6 and CBC Figure 11B-505.6.

   a. Exceptions:

      1) Where handrails are provided along walking surfaces with slopes not steeper than 1:20, the bottoms of handrail gripping surfaces shall be permitted to be obstructed along their entire length where they are integral to crash rails or bumper guards.
      2) The distance between horizontal projections and the bottom of the gripping surface shall be permitted to be reduced by 1/8 inch (3.2 mm) for each 1/2 inch (12.7 mm) of additional handrail perimeter dimension that exceeds 4 inches (102 mm).

7. Cross Section: Handrail gripping surfaces shall have a cross section complying with CBC Section 11B-505.7.1 or 11B-505.7.2 per CBC Section 11B-505.7.

   a. Circular Cross Section: Handrail gripping surfaces with a circular cross section shall have an outside diameter of 1-1/4 inches (32 mm) minimum and 2 inches (51 mm) maximum per CBC Section 11B-505.7.1.
   b. Non-Circular Cross Section: Handrail gripping surfaces with a non-circular cross section shall have a perimeter dimension of 4 inches (102 mm) minimum and 6-1/4 inches (159 mm) maximum, and a cross-section dimension of 2-1/4 inches (57 mm) maximum per CBC Section 11B-505.7.2 and CBC Figure 11B-505.7.2.

8. Surfaces: Handrail gripping surfaces and any surfaces adjacent to them shall be free of sharp or abrasive elements and shall have rounded edges per CBC Section 11B-505.8.
9. Fittings: Handrails shall not rotate within their fittings per CBC Section 11B-505.9.
10. Handrail Extensions: Handrail gripping surfaces shall extend beyond and in the same direction of stair flights and ramp runs per CBC Section 11B-505.10.

    a. Exceptions:

1) Extensions shall not be required for continuous handrails at the inside turn of switchback or dogleg stairs and ramps.
2) In assembly areas, extensions shall not be required for ramp handrails in aisles serving seating where the handrails are discontinuous to provide access to seating and to permit crossovers within aisles.
3) In alterations, share the extension of the handrail in the direction of stair flight or ramp run would create a hazard, the extension of the handrail may be turned 90 degrees from the direction of the stair flight or ramp run.

b. Top and Bottom Extension at Ramps: Ramp handrails shall extend horizontally above the landing for 12 inches (305 mm) minimum beyond the top and bottom of ramp runs. Extensions shall return to a wall, guard, or the landing surface, or shall be continuous to the handrail of an adjacent ramp run per CBC Section 11B-505.10.1.

c. Top Extension at Stairs: At the top of a stair flight, handrails shall extend horizontally above the landing for 12 inches (305 mm) minimum beginning directly above the first riser nosing. Extensions shall return to a wall, guard, or the landing surface, or shall be continuous to the handrail of an adjacent stair flight per CBC Section 11B-505.10.2 and CBC Figure 11B-505.10.2.

d. Bottom Extension at Stairs: At the bottom of a stair flight, handrails shall extend at the slope of the stair flight for a horizontal distance equal to one tread depth beyond the last riser nosing. The horizontal extension of a handrail shall be 12 inches (305 mm) long minimum and a height equal to that of the sloping portion of the handrail as measured above the stair nosings. Extension shall return to a wall, guard, or the landing surface, or shall be continuous to the handrail of an adjacent stair flight per CBC Section 11B-505.10.3 and CBC Figure 11B-505.10.3.

2.3 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.4 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Recycled Content of Steel Products: Recycled content not less than 20 percent.

C. Low-Emitting Materials: Paints and coatings shall comply with the requirements of authorities having jurisdiction.

2.5 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2 inch (38 mm) clearance from inside face of handrail to finished wall surface.

2.6 STEEL AND IRON

A. Tubing: ASTM A500 (cold formed) or ASTM A513.

B. Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

C. Plates, Shapes, and Bars: ASTM A36/A36M.

D. Woven-Metal Fabric:

1. Basis-of-Design Product: Subject to compliance with requirements, provide GKD Metal Fabrics; Omega 1500, or comparable product by another manufacturer.

a. Material: AISI Type 316 stainless steel.

2.7 FASTENERS

A. General: Provide the following:

1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B633 or ASTM F1941 (ASTM F1941M), Class Fe/Zn 5 for zinc coating.
2. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329 for zinc coating.
3. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
2. Provide Phillips or tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Torque-controlled expansion anchors.

1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941 (ASTM F1941M), Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F593 (ASTM F738M), and nuts, ASTM F594 (ASTM F836M).

2.8 MISCELLANEOUS MATERIALS

A. Welding Electrodes: Comply with AWS requirements.

B. Zinc-Rich Primer:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Tnemec Company, Inc.; Series 94-H2O Hydro-Zinc, or comparable product by another manufacturer.

a. Apply at a dry film thickness of not less than 2.5 to 3.5 mils (0.0635 to 0.0889 mm).

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

E. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. Water-Resistant Product: At exterior locations and where indicated provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.9 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage as indicated on Drawings.

1. Fabricate railings with welded connections unless otherwise indicated.

B. Shop Assembly: Assemble railings in shop to greatest extent possible.

1. Disassemble units only as necessary for shipping and handling limitations.
2. Use connections that maintain structural value of joined pieces.
3. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Weld connections to comply with the following:

1. Cope components at connections to provide close fit, or use fittings designed for this purpose.

2. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
3. Obtain fusion without undercut or overlap.
4. Remove welding flux immediately.
5. Weld connections, including at fittings, continuously unless otherwise indicated.
6. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

    a. Finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 - No evidence of welded joint.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible.

1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
2. Locate joints where least conspicuous.
3. Fabricate joints, seams, and other connections that will be exposed to weather in a manner to exclude water.
4. Provide weep holes where water may accumulate internally.

G. Cut, reinforce, drill, and tap railings as indicated to receive finish hardware, screws, and similar items.

H. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

I. Form Changes in Direction as Follows:

1. By radius bends of radius indicated or by inserting prefabricated elbow fittings of radius indicated.

J. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

K. Close exposed ends of railing members with prefabricated end fittings.

L. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.

M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

N. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

O. For railing posts set in concrete, provide steel sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with metal plate forming bottom closure.

2.10 STEEL AND IRON FINISHES

A. Galvanized Railings:

1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
2. Hot-dip galvanize steel railings where indicated, including hardware, after fabrication.
3. Comply with ASTM A123/A 123M for hot-dip galvanized railings.
4. Comply with ASTM A153/A153M for hot-dip galvanized hardware.
5. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
6. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

C. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, galvanize anchors to be embedded in exterior concrete or masonry.

D. Shop prime railings, fittings, brackets, fasteners, and sleeves unless they are to be embedded in concrete or masonry, or unless otherwise indicated.

E. Preparation for Shop Priming Galvanized Items: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

1. SSPC-SP 1, "Solvent Cleaning" to remove all soluble contamination. Thoroughly roughen the entire surface to be coated using compressed air nozzle brush off blast cleaning with a fine abrasive to achieve a uniform anchor profile of 1.0 to 2.0 mils (0.0254 to 0.0508 mm). Reference ASTM D 6386, Section 5.4.1.

F. Preparation for Shop Priming: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:

1. Shop: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

G. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

H. Preparation for Field Priming: Clean field welds, bolted connections, and areas where shop primer is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

1. SSPC-SP 11, "Power Tool Cleaning to Bare Metal" all welds and damaged zinc-rich primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3.5 m).

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches (50 mm) beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches (150 mm) of post.

3.4 ANCHORING POSTS

A. Use metal sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material or attached to post with set screws.

C. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

1. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

3.5 ATTACHING RAILINGS

A. Attach railings to wall with wall brackets. Provide brackets with 1-1/2 inch (38 mm) clearance between inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

B. Secure wall brackets to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.

3.6 REPAIR

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

a. Apply by brush or spray to provide a dry film thickness of not less than 2.5 mils (0.0635 mm).

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055213

This page intentionally left blank.

SECTION 057300 - DECORATIVE METAL RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Stainless steel decorative railings.

B. Related Requirements:

1. Section 055100 "Metal Stairs" for metal stairs.
2. Section 055213 "Pipe and Tube Railings" for railings fabricated from pipe and tube components.
3. Section 092216 "Non-Structural Metal Framing" for metal backing for anchoring railings.

1.3 DEFINITIONS

A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas and for pedestrian guidance and support, visual separation, or wall protection.

1.4 COORDINATION AND SCHEDULING

A. Coordinate installation of anchorages for railings.

1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.
2. Deliver items to Project site in time for installation.

B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not meet structural performance requirements.

1.5 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of railings assembled from standard components.
2. Grout.
3. Anchoring cement.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
3. Include plan at each level.

C. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Fittings and brackets.
3. Welded connections.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E894 and ASTM E935.

C. Evaluation Reports: For post-installed anchors.

1.7 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockups as indicated on Drawings or, if not indicated, as directed by Architect.
2. Build mockups for each form and finish of railing consisting of not less than two posts, top rail, infill area, and anchorage system components that are full height and are not less than 24 inches (600 mm) in length.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Stainless Steel Decorative Railings:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Handrail Design, Inc., HDI Railing Systems; Circum Round Post Stainless Steel Mechanically Fastened Railing System, or comparable product by another manufacturer.

a. Handrails: Handrails and other tubular components shall be fabricated from tubes not more than 1-1/2 inch (38 mm) outside diameter with 5/64 inch (2 mm) wall thickness or wall thickness required by structural loads. Remove sharp or rough areas on exposed surfaces.
b. Posts: Posts and other tubular components shall be fabricated from tubes 1.9 inch (49 mm) outside diameter with 0.109 inch (2.8 mm) wall thickness or wall thickness required by structural loads. Remove sharp or rough areas on exposed surfaces.

B. Source Limitations: Obtain each type of railing from single source from single manufacturer.

C. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods, including structural analysis, preconstruction testing, field testing, and in-service performance.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

2.2 ACCESSIBILITY REQUIREMENTS

A. Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

B. Ramps:

1. General: Ramps on accessible routes shall comply with CBC Section 11B-405 per CBC Section 11B-405.1.

a. Exception: In assembly areas, aisle ramps adjacent to seating and not serving elements required to be on an accessible route shall not be required to comply with CBC Section 11B-405.

2. Handrails: Ramp runs shall have handrails complying with CBC Section 11B-505 per CBC Section 11B-405.8.

a. Exceptions:

1) Reserved.
2) Reserved.
3) Curb ramps do not require handrails.

4) At door landings, handrails are not required on ramp runs less than 6 inches (152 mm) in rise or 72 inches (1829 mm) in length.

3. Edge Protection: Edge protection complying with CBC Section 11B-405.9.2 shall be provided on each side of a ramp runs and at each side of ramp landings per CBC Section 11B-405.9.

a. Exceptions:

1) Edge protection shall not be required on ramps that are not required to have handrails and have sides complying with CBC Section 11B-406.2.2.
2) Edge protection shall not be required on the sides of ramp landings serving an adjoining ramp run or stairway.
3) Edge protection shall not be required on the sides of ramp landings having a vertical drop-off of 1/2 inch (12.7 mm) maximum within 10 inches (254 mm) horizontally of the minimum landing area specified in CBC Section 11B-405.7.

b. Reserved.
c. Curb or Barrier: A curb, 2 inches (51 mm) high minimum, or a barrier shall be provided that prevents the passage of a 4 inch (102 mm) diameter sphere, where any portion of the sphere is within 4 inches (102 mm) of the finish floor or ground surface. To prevent wheel entrapment, the curb or barrier shall provide a continuous and uninterrupted barrier along the length of the ramp per CBC Section 11B-405.9.2.

C. Handrails:

1. General: Handrails provided along walking surfaces complying with CBC Section 11B-403, required at ramps complying with CBC Section 11B-405, and required at stairs complying with CBC Section 11B-504 shall comply with CBC Section 11B-505 per CBC Section 11B-505.1.
2. Where Required: Handrails shall be provided on both sides of stairs and ramps per CBC Section 11B-505.2.

a. Exceptions:

1) In assembly areas, handrails shall not be required on both sides of aisle ramps where a handrail is provided at either side or within the aisle width.
2) Curb ramps do not require handrails.
3) At door landings, handrails are not required when the ramp run is less than 6 inches (152 mm) in rise or 72 inches (1829 mm) in length.

b. Orientation: The orientation of at least one handrail shall be in the direction of the stair run, perpendicular to the direction of the stair nosing, and shall not reduce the minimum required width of the stair per CBC Section 11B-505.2.1.

3. Continuity: Handrails shall be continuous within the full length of each stair flight or ramp run. Inside handrails on switchback or dogleg stairs and ramps shall be continuous between flights or runs per CBC Section 11B-505.3.

a. Exception: In assembly areas ramp handrails adjacent to seating or within aisle width shall not be required to be continuous in aisles serving seating.

4. Height: Top of gripping surfaces of handrails shall be 34 inches (864 mm) minimum and 38 inches (965 mm) maximum vertically above walking surfaces, stair nosings, and ramp surfaces. Handrails

shall be at a consistent height above walking surfaces, stair nosings, and ramp surfaces per CBC Section 11B-505.4 and CBC Figure 11B-505.4.

5. Clearance: Clearance between handrail gripping surfaces and adjacent surfaces shall be 1-1/2 inches (38 mm) minimum. Handrails may be located in a recess if the recess is 3 inches (76 mm) maximum deep and 18 inches (457 mm) minimum clear above the top of the handrail per CBC Section 11B-505.5 and CBC Figure 11B-505.5.
6. Gripping Surface: Handrail gripping surfaces shall be continuous along their length and shall not be obstructed along their tops or sides. The bottoms of handrail gripping surfaces shall not be obstructed for more than 20 percent of their length. Where provided, horizontal projections shall occur 1-1/2 inches (38 mm) minimum below the bottom of the handrail gripping surface per CBC Section 11B-505.6 and CBC Figure 11B-505.6.

    a. Exceptions:

        1) Where handrails are provided along walking surfaces with slopes not steeper than 1:20, the bottoms of handrail gripping surfaces shall be permitted to be obstructed along their entire length where they are integral to crash rails or bumper guards.
        2) The distance between horizontal projections and the bottom of the gripping surface shall be permitted to be reduced by 1/8 inch (3.2 mm) for each 1/2 inch (12.7 mm) of additional handrail perimeter dimension that exceeds 4 inches (102 mm).

7. Cross Section: Handrail gripping surfaces shall have a cross section complying with CBC Section 11B-505.7.1 or 11B-505.7.2 per CBC Section 11B-505.7.

    a. Circular Cross Section: Handrail gripping surfaces with a circular cross section shall have an outside diameter of 1-1/4 inches (32 mm) minimum and 2 inches (51 mm) maximum per CBC Section 11B-505.7.1.
    b. Non-Circular Cross Section: Handrail gripping surfaces with a non-circular cross section shall have a perimeter dimension of 4 inches (102 mm) minimum and 6-1/4 inches (159 mm) maximum, and a cross-section dimension of 2-1/4 inches (57 mm) maximum per CBC Section 11B-505.7.2 and CBC Figure 11B-505.7.2.

8. Surfaces: Handrail gripping surfaces and any surfaces adjacent to them shall be free of sharp or abrasive elements and shall have rounded edges per CBC Section 11B-505.8.
9. Fittings: Handrails shall not rotate within their fittings per CBC Section 11B-505.9.
10. Handrail Extensions: Handrail gripping surfaces shall extend beyond and in the same direction of stair flights and ramp runs per CBC Section 11B-505.10.

    a. Exceptions:

        1) Extensions shall not be required for continuous handrails at the inside turn of switchback or dogleg stairs and ramps.
        2) In assembly areas, extensions shall not be required for ramp handrails in aisles serving seating where the handrails are discontinuous to provide access to seating and to permit crossovers within aisles.
        3) In alterations, share the extension of the handrail in the direction of stair flight or ramp run would create a hazard, the extension of the handrail may be turned 90 degrees from the direction of the stair flight or ramp run.

    b. Top and Bottom Extension at Ramps: Ramp handrails shall extend horizontally above the landing for 12 inches (305 mm) minimum beyond the top and bottom of ramp runs. Extensions

shall return to a wall, guard, or the landing surface, or shall be continuous to the handrail of an adjacent ramp run per CBC Section 11B-505.10.1.

c. Top Extension at Stairs: At the top of a stair flight, handrails shall extend horizontally above the landing for 12 inches (305 mm) minimum beginning directly above the first riser nosing. Extensions shall return to a wall, guard, or the landing surface, or shall be continuous to the handrail of an adjacent stair flight per CBC Section 11B-505.10.2 and CBC Figure 11B-505.10.2.

d. Bottom Extension at Stairs: At the bottom of a stair flight, handrails shall extend at the slope of the stair flight for a horizontal distance equal to one tread depth beyond the last riser nosing. The horizontal extension of a handrail shall be 12 inches (305 mm) long minimum and a height equal to that of the sloping portion of the handrail as measured above the stair nosings. Extension shall return to a wall, guard, or the landing surface, or shall be continuous to the handrail of an adjacent stair flight per CBC Section 11B-505.10.3 and CBC Figure 11B-505.10.3.

2.3 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior railings by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.4 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Recycled Content of Stainless Steel Products: Recycled content not less than 20 percent.

2.5 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.

1. Provide cast-metal brackets with flange tapped for concealed anchorage to threaded hanger bolt.

2.6 STAINLESS STEEL

A. Tubing: ASTM A554, Grade MT 304.

B. Pipe: ASTM A312/A312M, Grade TP 304.

C. Castings: ASTM A743/A743M, Grade CF 8 or CF 20.

D. Sheet, Strip, Plate, and Flat Bar: ASTM A666, Type 304.

E. Bars and Shapes: ASTM A276, Type 304.

F. Woven-Wire Mesh:

a. Basis-of-Design Product: Subject to compliance with requirements, provide McNichols Co.; Quality Techna 3150, Designer Series, Stainless Steel Type 304, 74% Open Area, or comparable product by another manufacturer.

2.7 FASTENERS

A. Fastener Materials: Unless otherwise indicated, provide the following:

1. Stainless Steel Components: Type 304 stainless steel fasteners.
2. Dissimilar Metals: Type 304 stainless steel fasteners.

B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless otherwise indicated.

1. Provide Phillips, tamper-resistant, or square or hex socket flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Torque-controlled expansion anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941 (ASTM F1941M), Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless steel bolts, ASTM F593 (ASTM F738M), and nuts, ASTM F594 (ASTM F836M).

2.8 MISCELLANEOUS MATERIALS

A. Welding Electrodes: Comply with AWS requirements.

B. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

C. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. Water-Resistant Product: At exterior locations and where indicated provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.9 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage as indicated on Drawings.

1. Fabricate railings with nonwelded connections unless otherwise indicated.

B. Shop Assembly: Assemble railings in shop to greatest extent possible.

1. Disassemble units only as necessary for shipping and handling limitations.
2. Use connections that maintain structural value of joined pieces.
3. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Weld connections to comply with the following:

1. Cope components at connections to provide close fit, or use fittings designed for this purpose.
2. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
3. Obtain fusion without undercut or overlap.
4. Remove welding flux immediately.
5. Weld connections, including at fittings, continuously unless otherwise indicated.
6. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

a. Finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 - No evidence of welded joint.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible.

1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
2. Locate joints where least conspicuous.
3. Fabricate joints, seams, and other connections that will be exposed to weather in a manner to exclude water.
4. Provide weep holes where water may accumulate internally.

G. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

H. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

I. Form changes in direction as follows:

1. By radius bends of radius indicated or by inserting prefabricated elbow fittings of radius indicated.

J. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

K. Close exposed ends of hollow railing members with prefabricated end fittings.

L. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns, unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.

M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

N. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

O. For railing posts set in concrete, provide stainless steel sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with metal plate forming bottom closure.

P. Woven-Wire Mesh Infill Panels:

1. Make wire mesh and frames from stainless steel.
2. Orient wire mesh with wires perpendicular and parallel to top rail.
3. Continuous frames for infill panels shall be fabricated from rectangular tubes 1/2 by 1-1/5 inch (12.7 by 38 mm) with wall thickness required by structural loads. Remove sharp or rough areas on exposed surfaces.

2.10 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.11 STAINLESS STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run grain of directional finishes with long dimension of each piece.

C. Directional Satin Finish: ASTM A480/A480M, No. 4.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (5 mm in 3 m).

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches (50 mm) beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches (150 mm) of post.

3.4 ANCHORING POSTS

A. Use metal sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Cover anchorage joint with flange of same metal as post, attached to post with set screws.

C. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

1. For stainless steel railings, weld flanges to posts and bolt to metal-supporting surfaces.

3.5 ATTACHING RAILINGS

A. Attach handrails to walls with wall brackets. Provide brackets with 1-1/2 inch (38 mm) clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

1. Use type of bracket with [**flange tapped for concealed anchorage to threaded hanger bolt**] [**predrilled hole for exposed bolt anchorage**].
2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

B. Secure wall brackets to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.

3.6 CLEANING

A. Clean stainless steel by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.

3.7 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 057300

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Wood blocking, cants, and nailers.
2. Wood furring.
3. Plywood backing panels.

B. Related Requirements:

1. Section 061600 "Sheathing" for sheathing, subflooring, and underlayment.

1.3 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal (38 mm actual) size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater size but less than 5 inches nominal (114 mm actual) size in least dimension.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Post-installed anchors.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: Not more than 19 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Treatment shall not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D5664, and design value adjustment factors shall be calculated according to ASTM D6841.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

E. Application: Treat items indicated on Drawings, and the following:

1. Framing for raised platforms.
2. Concealed blocking.
3. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Cants.
3. Nailers.
4. Furring.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.

C. Concealed Boards: Construction or No. 2 grade lumber of any species.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

F. For furring strips for installing plywood backing panels, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated on Drawings but not less than 3/4 inch (19 mm) nominal thickness.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M or of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F1667.

C. Screws for Fastening to Cold-Formed Metal Framing: ASTM C954, length as recommended by screw manufacturer for material being fastened.

D. Screws for Fastening to Non-Structural Metal Framing: ASTM C1002, length as recommended by screw manufacturer for material being fastened.

E. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

F. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 or ICC-ES AC193 as appropriate for the substrate.

1. Material for Interior Locations: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.

2. Material for Exterior Locations: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2 (ASTM F738M and ASTM F836M, Grade A1 or A4).

2.7 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

C. Install plywood backing panels by fastening to studs or furring; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

D. Do not splice structural members between supports unless otherwise indicated.

E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.

F. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches (2438 mm) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches (2438 mm) o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2 inch nominal (38 mm actual) thickness.
3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. (9.3 sq. m) and to solidly fill space below partitions.
4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet (6 m) o.c.

G. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

H. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

I. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

J. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.10.1, "Fastening Schedule," in the CBC.
2. ICC-ES evaluation report for fastener.

K. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD BLOCKING AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.3 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Plywood Backing Panels: Install 1 by 3 inch nominal (19 by 63 mm actual) size furring horizontally or vertically at 24 inches (610 mm) o.c.

3.4 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061053

This page intentionally left blank.

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Parapet sheathing.
3. Sheathing joint and penetration treatment.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for plywood backing panels.
2. Section 072500 "Weather Barriers" for water-resistive barrier applied over wall sheathing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: As tested according to ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Finish Material Pollutant Control: Finish materials shall comply with CGBC Sections 5.504.4.1 through 5.504.4.6 per CGBC Section 5.504.4.

1. Adhesives, Sealants, and Caulks: Adhesives, sealants, and caulks used on the project shall meet the requirements of the following standards per CGBC Section 5.504.4.1:

a. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in CBC Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products specified in subparagraph below.
b. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

2. Sealants and sealant primers shall comply with maximum VOC limits listed in CGBC Table 5.504.4.2.

C. VOC Content: Sealants and sealant primers shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Architectural Sealants: 250 g/L.
2. Architectural Sealant Primers for Nonporous Substrates: 250 g/L.
3. Architectural Sealant Primers for Porous Substrates: 775 g/L.

D. Low-Emitting Materials: Sealants and sealant primers shall comply with the requirements of authorities having jurisdiction.

2.3 WOOD PANEL PRODUCTS

A. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

B. Factory mark panels to indicate compliance with applicable standard.

2.4 WALL SHEATHING

A. Glass-Mat Gypsum Sheathing: ASTM C1177/C1177M.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. CertainTeed Corporation.
b. Continental Building Products, LLC.
c. Georgia-Pacific Gypsum LLC.

d. National Gypsum Company.
e. USG Corporation.

2. Type and Thickness: Type X, 5/8 inch (15.9 mm) thick.
3. Size: 48 by 96 inches (1219 by 2438 mm) for vertical or horizontal installation.

2.5 PARAPET SHEATHING

A. Plywood Sheathing: DOC PS 1, Exterior, Structural I sheathing.

1. Span Rating: Not less than 16/0.
2. Nominal Thickness: As indicated on Drawings but not less than 15/32 inch (11.9 mm).

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For parapet and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M or of Type 304 stainless steel.

B. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

C. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.

1. For non-structural metal framing less than 0.0329 inch (0.836 mm) thick (20 gage nominal), use screws that comply with ASTM C1002.
2. For cold-formed metal framing from 0.0329 to 0.1180 inch (0.836 to 2.997 mm) thick (20 to 10 gage nominal), use screws that comply with ASTM C954.

2.7 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

1. Sheathing Tape: Self-adhering, glass-fiber tape, not less than 2 inches (50 mm) wide, 10 by 10 or 10 by 20 threads/inch (390 by 390 or 390 by 780 threads/m), of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Table 2304.10.1, "Fastening Schedule," in the CBC.
2. ICC-ES evaluation report for fastener.

D. Coordinate wall and parapet sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Parapet Sheathing:

a. Screw to cold-formed metal framing.
b. Space panels 1/8 inch (3 mm) apart at edges and ends.

3.3 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to cold-formed metal framing with screws.
2. Install panels with a 3/8 inch (9.5 mm) gap where non-load-bearing construction abuts structural elements.
3. Install panels with a 1/4 inch (6.4 mm) gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent panels without forcing. Abut ends over centers of studs, and stagger end joints of adjacent panels not less than one stud spacing. Attach at perimeter and within field of panel to each stud.

1. Space fasteners approximately 8 inches (200 mm) o.c. and set back not less than 3/8 inch (9.5 mm) from edges and ends of panels.

D. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.

1. Space fasteners approximately 8 inches (200 mm) o.c. and set back not less than 3/8 inch (9.5 mm) from edges and ends of panels.

E. Seal penetrations and other openings according to sheathing manufacturer's written instructions.

1. Apply glass-fiber sheathing tape to penetrations and other openings in glass-mat gypsum sheathing and apply and trowel sealant to embed entire face of tape in sealant.

END OF SECTION 061600

This page intentionally left blank.

SECTION 064116 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Plastic-laminate-clad architectural cabinets.
2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-clad architectural cabinets that are not concealed within other construction.

B. Related Requirements:

1. Section 054000 "Cold-Formed Metal Framing" for metal backing required for installing cabinets and concealed within other construction before cabinet installation.
2. Section 092216 "Non-Structural Metal Framing" for metal backing required for installing cabinets and concealed within other construction before cabinet installation.
3. Section 123623.13 "Plastic-Laminate-Clad Countertops."
4. Section 123661.16 "Solid Surfacing Countertops."
5. Section 123661.19 "Quartz Agglomerate Countertops."

1.3 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

B. Keying Conference: Conduct conference at Project site. Incorporate keying conference decisions into final keying requirements.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Show locations and sizes of attachment devices, furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.
4. Apply WI Certified Compliance Program label to Shop Drawings.

C. Keying Schedule: Include schematic keying diagram and index each key set to unique designations that are coordinated with the Contract Documents.

D. Samples for Verification: For the following:

1. Plastic Laminates: 12 by 12 inches (300 by 300 mm), for each type, color, pattern, and surface finish required.

a. Provide one sample applied to core material with specified edge material applied to one edge.

2. Thermoset Decorative Panels: 12 by 12 inches (300 by 300 mm), for each color, pattern, and surface finish.

a. Provide edge banding on one edge.

3. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Product Certificates: For each type of product.

C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

D. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: WI Certified Compliance Program certificates.

B. Seismic Installation Compliance Certificates: WI Certified Seismic Installation Program certificates.

1.8 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1. Manufacturer's Certification: Licensed participant in WI's Certified Compliance Program.

B. Installer Qualifications: Manufacturer of products. Licensed participant in WI's Certified Compliance Program.

C. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

D. Certified Seismic Installation Program:

1. Before walls are closed up provide a written WI Certified Seismic Installation Program report confirming that backing is provided in all locations required for casework installation or identifying those locations where backing is missing or improperly located.
2. On completion of installation provide a WI Certified Seismic Installation Program Certificate, identifying the work covered and certifying that installation meets the requirements of the WI Certified Seismic Installation Program attachment details and schedules.
3. All fees charged by WI for the Certified Seismic Installation Program are the responsibility of the installer and shall be included in their bid.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 ACCESSIBILITY REQUIREMENTS

A. Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

B. Operable Parts:

1. General: Operable parts shall comply with CBC Section 11B-309 per CBC Section 11B-309.1.
2. Operation: Operable parts shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate operable parts shall be 5 pounds (22.2 N) maximum per CBC Section 11B-309.4.

C. Provide "U" shaped wire pulls at all accessible casework with a minimum projection of 1-1/2 inches (37.5 mm).

2.2 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Regional Materials: Plastic-laminate cabinets shall be manufactured within 500 miles (800 km) of Project site.

C. Recycled Content of Particleboard: Recycled content not less than 20 percent.

D. Recycled Content of Medium-Density Fiberboard: Recycled content not less than 20 percent.

E. Hardwood Plywood:

1. Composite Wood Products: Hardwood plywood, particleboard and medium density fiberboard composite wood products used on the interior or exterior of the building shall meet the requirements for formaldehyde as specified in California Air Resources Board's (CARB) Air Toxics Control Measure (ATCM) for Composite Wood (17 CCR 93120 et seq.) per CGBC Section 5.504.4.5. Those materials not exempted under ATCM must meet the specified emission limits, as shown in CGBC Table 5.504.4.5.
2. Composite Wood Products: Products shall be made without urea formaldehyde.
3. Hardwood Plywood Veneer Core: Formaldehyde emissions shall not exceed 0.05 ppm per CGBC Table 5.504.4.5.
4. Hardwood Plywood Composite Core: Formaldehyde emissions shall not exceed 0.05 ppm per CGBC Table 5.504.4.5.

F. Particleboard:

1. Composite Wood Products: Hardwood plywood, particleboard and medium density fiberboard composite wood products used on the interior or exterior of the building shall meet the requirements for formaldehyde as specified in California Air Resources Board's (CARB) Air Toxics Control Measure (ATCM) for Composite Wood (17 CCR 93120 et seq.) per CGBC Section 5.504.4.5. Those materials not exempted under ATCM must meet the specified emission limits, as shown in CGBC Table 5.504.4.5.
2. Composite Wood Products: Products shall be made without urea formaldehyde.
3. Formaldehyde emissions shall not exceed 0.09 ppm per CGBC Table 5.504.4.5.

G. Medium-Density Fiberboard:

1. Composite Wood Products: Hardwood plywood, particleboard and medium density fiberboard composite wood products used on the interior or exterior of the building shall meet the requirements for formaldehyde as specified in California Air Resources Board's (CARB) Air Toxics Control Measure (ATCM) for Composite Wood (17 CCR 93120 et seq.) per CGBC Section 5.504.4.5. Those

materials not exempted under ATCM must meet the specified emission limits, as shown in CGBC Table 5.504.4.5.
2. Composite Wood Products: Products shall be made without urea formaldehyde.
3. Formaldehyde emissions shall not exceed 0.11 ppm per CGBC Table 5.504.4.5.

H. Thermoset Decorative Panels:

1. Composite Wood Products: Hardwood plywood, particleboard and medium density fiberboard composite wood products used on the interior or exterior of the building shall meet the requirements for formaldehyde as specified in California Air Resources Board's (CARB) Air Toxics Control Measure (ATCM) for Composite Wood (17 CCR 93120 et seq.) per CGBC Section 5.504.4.5. Those materials not exempted under ATCM must meet the specified emission limits, as shown in CGBC Table 5.504.4.5.
2. Composite Wood Products: Products shall be made without urea formaldehyde.
3. Thermoset Decorative Panels Particleboard Core: Formaldehyde emissions shall not exceed 0.09 ppm per CGBC Table 5.504.4.5.
4. Thermoset Decorative Panels Medium-Density Fiberboard Core: Formaldehyde emissions shall not exceed 0.11 ppm per CGBC Table 5.504.4.5.

I. Finish Material Pollutant Control: Finish materials shall comply with CGBC Sections 5.504.4.1 through 5.504.4.6 per CGBC Section 5.504.4.

1. Adhesives, Sealants, and Caulks: Adhesives, sealants, and caulks used on the project shall meet the requirements of the following standards per CGBC Section 5.504.4.1:

   a. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in CBC Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products specified in subparagraph below.
   b. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

2. Adhesives shall comply with maximum VOC limits listed in CGBC Table 5.504.4.1.
3. Sealants and sealant primers shall comply with maximum VOC limits listed in CGBC Table 5.504.4.2.

J. VOC Content: Adhesives shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Multipurpose Construction Adhesives: 70 g/L.
2. Structural Wood Member Adhesives: 140 g/L.
3. Wood Glues: 30 g/L.

K. VOC Content: Sealants and sealant primers shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Architectural Sealants: 250 g/L.
2. Architectural Sealant Primers for Nonporous Substrates: 250 g/L.

3. Architectural Sealant Primers for Porous Substrates: 775 g/L.

L. Adhesives: Do not use adhesives that contain urea formaldehyde.

M. Low-Emitting Materials: Adhesives shall comply with the requirements of authorities having jurisdiction.

N. Low-Emitting Materials: Sealants and sealant primers shall comply with the requirements of authorities having jurisdiction.

2.3 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the "North American Architectural Woodwork Standards 3.1" for grades of cabinets indicated for construction, finishes, installation, and other requirements.

1. Provide labels and certificates from WI certification program indicating that woodwork and installation complies with requirements of grades specified.
2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

B. North American Architectural Woodwork Standards 3.1 Grade: Custom.

C. Type of Construction: Frameless.

D. Door and Drawer-Front Style: Flush overlay.

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Abet Laminati Inc.
b. Formica Corporation.
c. Lamin-Art, Inc.
d. Pionite; a Panolam Industries International, Inc. brand.
e. Wilsonart LLC.

F. Laminate Cladding for Exposed Surfaces:

1. Horizontal Surfaces: Grade HGS.
2. Postformed Surfaces: Grade HGP.
3. Vertical Surfaces: Grade HGS.
4. Edges: Grade HGS.
5. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels unless otherwise indicated.

G. Materials for Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.

a. Edges of Plastic-Laminate Shelves: PVC edge banding, 0.12 inch (3 mm) thick, matching laminate in color, pattern, and finish.

1) Provide edge banding on all four edges of adjustable shelves.

b. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.

1) Provide edge banding on all four edges of adjustable shelves.

c. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.

2. Drawer Sides and Backs: Solid-hardwood lumber or Baltic birch plywood.
3. Drawer Bottoms: Baltic birch plywood.
4. Shelves:

a. Exposed Shelves: Particleboard or plywood with plastic-laminate cladding.
b. Semiexposed Shelves: Particleboard or plywood with thermoset decorative finish.

H. Dust Panels: 1/4 inch (6.4 mm) plywood or tempered hardboard above compartments and drawers unless located directly under tops.

I. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

J. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.

K. Shelves: Load factor of not less than 50 lbs/sq ft (22.7 kg/sq cm). Comply with the following:

1. 3/4 inch (19.1 mm) particleboard for shelves not more than 25 inches (635 mm) long.
2. 1 inch (25.4 mm) particleboard for shelves not more than 34 inches (864 mm) long.
3. 3/4 inch (19.1 mm) plywood for shelves not more than 46 inches (1168 mm) long.
4. 1 inch (25.4 mm) plywood for shelves not more than 61 inches (1549 mm) long.

L. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As indicated on Drawings or, if not indicated, as selected by Architect from laminate manufacturer's full range.

2.4 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130, made with binder containing no urea formaldehyde.
2. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde, or Grade M-2-Exterior Glue.
3. Softwood Plywood: DOC PS 1, made with binder containing no urea formaldehyde.
4. Baltic Birch Plywood: Grade B/BB, made with binder containing no urea formaldehyde.

    a. 3/4 inch (18 mm) thick Baltic birch plywood shall have not less than 13 plies.
    b. 1/2 inch (12 mm) thick Baltic birch plywood shall have not less than 9 plies.
    c. 3/8 inch (9 mm) thick Baltic birch plywood shall have not less than 7 plies.
    d. 1/4 inch (6 mm) thick Baltic birch plywood shall have not less than 5 plies.
    e. 1/8 inch (3 mm) thick Baltic birch plywood shall have not less than 3 plies.

5. Thermoset Decorative Panels: Particleboard or medium-density fiberboard, made with binder containing no urea formaldehyde, finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.5 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
2. For items indicated to receive a stained or natural finish, use organic resin chemical formulation.
3. Mill lumber before treatment and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of architectural cabinets.

C. Fire-Retardant Particleboard: Made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E84.

1. For panels 3/4 inch (19 mm) thick and less, comply with ANSI A208.1 for Grade M-2 except for the following minimum properties: modulus of rupture, 1600 psi (11 MPa); modulus of elasticity, 300,000 psi (2070 MPa); internal bond, 80 psi (550 kPa); and screw-holding capacity on face and edge, 250 and 225 lbf (1100 and 1000 N), respectively.
2. For panels 13/16 to 1-1/4 inches (20 to 32 mm) thick, comply with ANSI A208.1 for Grade M-1 except for the following minimum properties: modulus of rupture, 1300 psi (9 MPa); modulus of elasticity, 250,000 psi (1720 MPa); linear expansion, 0.50 percent; and screw-holding capacity on face and edge, 250 and 175 lbf (1100 and 780 N), respectively.
3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Arauco North America.
    b. Timber Products Company.

D. Fire-Retardant Fiberboard: MDF panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E84.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Panel Source International, Inc.
    b. Roseburg.

2.6 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.

B. Butt Hinges: Heavy duty, 2-3/4 inch (70 mm), five-knuckle institutional steel hinges, mill ground, with hospital tips, made from 0.095 inch (2.4 mm) thick metal, and as follows:

1. Semiconcealed Hinges for Overlay Doors: BHMA A156.9, B01521.

    a. Basis-of-Design Product: Rockford Process; RPC 376.

C. Wire Pulls: Back mounted, solid metal, 4 inches (100 mm) long, 1-1/2 inches (37.5 mm) deep, and 5/16 inch (8 mm) in diameter.

1. Basis-of-Design Manufacturer: Rockford Process.

D. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

1. Shelf Standard (Pilaster) Basis-of-Design Product: K&V; 255 ZC, Zinc Coated Steel.
2. Shelf Support Basis-of-Design Product: K&V; 256R ZC, Zinc Coated Steel with Rubber Cushion.

E. Drawer Slides: BHMA A156.9.

1. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
1. For drawers not more than 3 inches (75 mm) high and not more than 16 inches (400 mm) wide, provide Grade 1HD-100.

a. Basis-of-Design Product: Accuride; No. 2632.

2. For drawers not more than 3 inches (75 mm) high and not more than 24 inches (600 mm) wide, provide Grade 1HD-100.

a. Basis-of-Design Product: Accuride; No. 7432.

3. For drawers not more than 6 inches (150 mm) high and not more than 16 inches (400 mm) wide, provide Grade 1HD-100.

a. Basis-of-Design Product: Accuride; No. 3832.

4. For drawers not more than 6 inches (150 mm) high and not more than 24 inches (600 mm) wide, provide Grade 1HD-100.

a. Basis-of-Design Product: Accuride; No. 7432.

5. For drawers more than 6 inches (150 mm) high and not more than 42 inches (1000 mm) wide, provide Grade 1HD-200.

a. Basis-of-Design Product: Accuride; No. 3640.

6. Keyboard Tray Slides: Grade 1HD-100; for computer keyboard tray not more than 16 inches (400 mm) wide.

a. Basis-of-Design Product: Accuride; No. 2109.

7. Keyboard Tray:

a. Basis-of-Design Product: Accuride; CBERGO-300 Keyboard Tray.

8. For trash bins not more than 20 inches (500 mm) high and not more than 16 inches (400 mm) wide, provide Grade 1HD-100.

a. Basis-of-Design Product: Accuride; No. 3600-200/201 StowAway.

F. Door Locks: BHMA A156.11, E07121, with five-pin tumbler.

1. Basis-of-Design Product: Olympus Lock, Inc.; 100 Series Cabinet Door Lock, Small Pin, N Series: National Keyway, Grade 1.

a. Body: Zinc die cast lock body.
b. Cylinder: Solid brass pin tumbler cylinder.
c. Keyway: National D4292 (5 pin) keyway.
d. Master Key: GM2.
e. Strike: 56-1 bar strike.

2. Provide locks on doors where indicated on Drawings.
3. Provide a minimum of two keys per lock and two master keys.
4. Keying: Key door and drawer locks alike within each room; key each room separately unless otherwise indicated.
5. Master Key System: Key all locks to be operable by master key.

G. Drawer Locks: BHMA A156.11, E07041, with five-pin tumbler.

1. Basis-of-Design Product: Olympus Lock, Inc.; 200 Series Cabinet Door Lock, Small Pin, N Series: National Keyway, Grade 1.

    a. Body: Zinc die cast lock body.
    b. Cylinder: Solid brass pin tumbler cylinder.
    c. Keyway: National D4292 (5 pin) keyway.
    d. Master Key: GM2.
    e. Strike: 12-3 angle strike.

2. Provide locks on drawers where indicated on Drawings.
3. Provide a minimum of two keys per lock and two master keys.
4. Keying: Key door and drawer locks alike within each room; key each room separately unless otherwise indicated.
5. Master Key System: Key all locks to be operable by master key.

H. Door and Drawer Silencers: BHMA A156.16, L03011.

I. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated. Provide one of the following:

1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
2. Satin Stainless Steel: BHMA 630.

J. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.7 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Sealants: Comply with requirements in Section 079200 "Joint Sealants."

2.8 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Fabricate architectural cabinets to dimensions, profiles, and details indicated.

C. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect not less than seven days in advance of the dates and times architectural cabinet fabrication will be complete.
2. Trial fit assemblies at manufacturer's shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.

D. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

3.2 INSTALLATION

A. North American Architectural Woodwork Standards 3.1 Grade: Install cabinets to comply with quality standard grade of item to be installed.

B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.

C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.

1. Comply with requirements of WI Certified Seismic Installation Program.

D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm) using concealed shims.

1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (400 mm) o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

    a. Comply with requirements of WI Certified Seismic Installation Program.

3.3 FIELD QUALITY CONTROL

A. Inspections:

1. Provide inspection of installed Work through WI's Certified Compliance Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.

    a. Inspection entity shall prepare and submit report of inspection.

2. Provide inspection of installed Work certifying that installation complies with requirements of the WI Certified Seismic Installation Program.

    a. Inspection entity shall prepare and submit report of inspection.
    b. Provide inspection reports and certification as required in Part 1 of this Section.

3.4 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION 064116

This page intentionally left blank.

SECTION 066400 - PLASTIC PANELING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Plastic sheet paneling.

B. Related Requirements:

1. Section 092900 "Gypsum Board" for installation of gypsum board substrate for installing plastic paneling.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.4 QUALITY ASSURANCE

A. Testing Agency: Acceptable to authorities having jurisdiction.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

2.2 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Finish Material Pollutant Control: Finish materials shall comply with CGBC Sections 5.504.4.1 through 5.504.4.6 per CGBC Section 5.504.4.

1. Adhesives, Sealants, and Caulks: Adhesives, sealants, and caulks used on the project shall meet the requirements of the following standards per CGBC Section 5.504.4.1:

a. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in CBC Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products specified in subparagraph below.
b. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

2. Adhesives shall comply with maximum VOC limits listed in CGBC Table 5.504.4.1.
3. Sealants and sealant primers shall comply with maximum VOC limits listed in CGBC Table 5.504.4.2.

C. VOC Content: Adhesives shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Drywall and Panel Adhesives: 50 g/L.

D. VOC Content: Sealants and sealant primers shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Architectural Sealants: 250 g/L.
2. Architectural Sealant Primers for Nonporous Substrates: 250 g/L.
3. Architectural Sealant Primers for Porous Substrates: 775 g/L.

E. Adhesives: Do not use adhesives that contain urea formaldehyde.

F. Low-Emitting Materials: Adhesives shall comply with the requirements of authorities having jurisdiction.

G. Low-Emitting Materials: Sealants and sealant primers shall comply with the requirements of authorities having jurisdiction.

2.3 PLASTIC SHEET PANELING

A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D 5319. Where indicated panels shall be USDA accepted for incidental food contact.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Marlite; P100, Class A, or a comparable product by one of the following:

a. Crane Composites, Inc.
b. Glasteel.
c. Newcourt, Inc.
d. Nudo Products, Inc.
e. Parkland Plastics, Inc.

2. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E 84. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

3. Nominal Thickness: Not less than 0.09 inch (2.3 mm).
4. Surface Finish: Molded pebble texture.
5. Color: White unless otherwise indicated.

2.4 ACCESSORIES

A. Trim Accessories: Manufacturer's standard one-piece or two-piece, snap-on vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.

1. Color: Match panels unless otherwise indicated.

B. Adhesive: As recommended by plastic paneling manufacturer.

C. Sealant: Mildew-resistant, single-component, neutral-curing or acid-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

B. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.

C. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

D. Lay out paneling before installing. Locate panel joints so that trimmed panels at corners are not less than 12 inches (300 mm) wide.

1. Mark plumb lines on substrate at trim accessory and panel joint locations for accurate installation.
2. Locate trim accessories and panel joints to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Install panels in a full spread of adhesive.

C. Install trim accessories with adhesive and nails or staples. Do not fasten through panels.

D. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.

E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

F. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 066400

SECTION 071616 - CRYSTALLINE WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Crystalline waterproofing.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for concrete slabs serving as protective topping for waterproofing and the finishing of concrete walls and slabs to receive waterproofing.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, and installation instructions.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Applicator.

B. Product Certificates: For each type of waterproofing, patching, and plugging material.

C. Product Test Reports: For each product formulation, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Applicator Qualifications:

1. A firm experienced in applying crystalline waterproofing similar in material, design, and extent to that indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
2. Applicator shall be approved by the manufacturer, experienced in surface preparation and application of the material and shall be subject to inspection and control by the manufacturer.
3. Applicator shall have not less than three years experience applying the specified waterproofing systems, and shall have been certified and trained by the manufacturer.

B. Manufacturer Qualifications:

1. Manufacturer shall have not less than five years experience in manufacturing crystallizing cementitious waterproofing systems. The system shall be specifically formulated and marketed for waterproofing. System design shall not have changed for not less than five consecutive years prior to start of the work.

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockup of typical vertical and horizontal surfaces not less than 10 sq. ft. (0.9 sq. m) in size.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the job site in their original unopened containers, clearly labeled with the manufacturer's name and brand designation.

B. Store products in an approved ventilated dry area; protect from contact with soil, dampness, freezing and direct sunlight.

C. Handle products in a manner that will prevent breakage of containers and damage to products.

D. Liquids should not be stored in areas with temperatures in excess of 90 deg F (32 deg C) or below 40 deg F (4.4 deg C).

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit crystalline waterproofing to be performed according to manufacturer's written instructions.

B. Proceed with waterproofing work only after pipe sleeves, vents, curbs, inserts, drains, and other projections through the substrate to be waterproofed have been completed. Proceed only after substrate defects, including honeycombs, voids, and cracks, have been repaired to provide a sound substrate free of forming materials, including reveal inserts.

C. Ambient Conditions: Proceed with waterproofing work only if temperature is maintained at 40 deg F (4.4 deg C) or above during work and cure period, and space is well ventilated and kept free of water.

1.9 WARRANTY

A. Applicator's Special Warranty: Specified form, signed by Applicator, covering Work of this Section, for warranty period of two years after Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Waterproofing System: Obtain waterproofing materials from single source from single manufacturer.

2.2 WATERPROOFING MATERIALS

A. Crystalline Waterproofing: Prepackaged, gray-colored proprietary blend of portland cement, specially treated sand, and active chemicals that, when mixed with water and applied, penetrates into concrete and concrete unit masonry and reacts chemically with the byproducts of cement hydration in the presence of water to develop crystalline growth within substrate capillaries to produce an impervious, dense, waterproof substrate; with properties complying with or exceeding the criteria specified below.

1. Basis-of-Design Product: Subject to compliance with requirements, provide KOSTER American Corporation; NB 1 Grey, or a comparable product by one of the following:

a. Anti-Hydro International, Inc.
b. AQUAFIN, Inc.
c. BASF Corporation.
d. Conproco Corporation.
e. Euclid Chemical Company (The); an RPM company.
f. Gemite Products Inc.
g. ICS Penetron International Ltd.
h. International Chem-Crete, Inc.
i. IPA Systems, Inc.
j. Kryton International Inc.
k. Xypex Chemical Corporation.

2. Water Permeability: Not more than zero for water at 461 feet (141 m) when tested according to COE CRD-C 48.
3. Compressive Strength: Not less than 3330 psi (23.0 MPa) at 28 days when tested according to ASTM C109/C109M.

2.3 ACCESSORY MATERIALS

A. Patching Compound: Factory-premixed cementitious repair mortar, crack filler, or sealant recommended by waterproofing manufacturer for filling and patching tie holes, honeycombs, reveals, and other imperfections; and compatible with substrate and other materials indicated.

B. Plugging Compound: Factory-premixed cementitious compound with hydrophobic properties and recommended by waterproofing manufacturer; resistant to water and moisture but vapor permeable for all

standard applications (vertical, overhead, and horizontal surfaces not exposed to vehicular traffic); and compatible with substrate and other materials indicated.

C. Water: Potable.

2.4 MIXES

A. Crystalline Waterproofing: Add prepackaged dry ingredients to water according to manufacturer's written instructions. Mix together with mechanical mixer or by hand to required consistency.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for suitable conditions where waterproofing is to be applied.

B. Proceed with application only after unsatisfactory conditions have been corrected.

C. Notify Architect in writing of active leaks or defects that would affect system performance.

3.2 PREPARATION

A. Comply with manufacturer's written instructions.

B. Protect other work from damage caused by cleaning, preparation, and application of waterproofing. Provide temporary enclosure to confine spraying operation and to ensure adequate ambient temperatures and ventilation conditions for application.

C. Do not allow waterproofing, patching, and plugging materials to enter reveals or annular spaces intended for resilient sealants or gaskets, such as joint spaces between pipes and pipe sleeves.

D. Stop active water leaks with plugging compound.

E. Repair damaged or unsatisfactory substrate with patching compound.

1. At holes and cracks not less than 1/16 inch (1.6 mm) wide in substrate, remove loosened chips and cut reveal with sides perpendicular to surface, not tapered, and not less than 1 inch (25 mm) deep. Fill reveal with patching compound flush with surface.

F. Surface Preparation: Remove efflorescence, chalk, dust, dirt, mortar spatter, grease, oils, paint, curing compounds, and form-release agents to ensure that waterproofing bonds to surfaces.

1. Clean concrete surfaces according to ASTM D4258.

a. Scratch- and Float-Finished Concrete: Etch with 10 percent muriatic acid solution according to ASTM D4260.

b. Smooth-Formed and Trowel-Finished Concrete: Prepare by mechanical abrading or abrasive-blast cleaning according to ASTM D4259.

2. Concrete Joints: Clean reveals.

3.3 APPLICATION

A. Comply with waterproofing manufacturer's written instructions for application and curing.

1. Saturate surface with water for several hours and maintain damp condition until applying waterproofing. Remove standing water.
2. Apply waterproofing to surfaces, and extend waterproofing onto adjacent surfaces as follows:

a. Onto columns integral with treated walls.
b. Onto interior nontreated walls intersecting exterior treated walls, for a distance of 24 inches (600 mm) for cast-in-place concrete.
c. Onto exterior walls and onto both exterior and interior columns, for a height of 12 inches (300 mm), where floors, but not walls, are treated.
d. Onto every substrate in areas indicated for treatment, including pipe trenches, pipe chases, pits, sumps, and similar offsets and features.

3. Number of Coats: Number required for specified water permeability but not less than two.
4. Application Method: Apply to ensure that each coat fills voids and is in full contact with substrate or previous coat.
5. Dampen surface between coats.

B. Final Coat Finish: Smooth, brushed, or spray textured.

C. Curing: Moist-cure waterproofing for three days immediately after final coat has set, followed by air drying, unless otherwise recommended in writing by manufacturer.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed application of waterproofing.

B. Prepare test and inspection reports.

3.5 PROTECTION

A. Protect cementitious waterproofing from contact with acid (below pH 7) and sulfates in concentrations exceeding limits for Portland Cement Type I/II.

B. Touch-up, repair or replace damaged products before Substantial Completion.

C. The treated area must be kept clear for at least 48 hours before backfilling or applying any concrete screed or other topping.

D. Protect the treated area from temperatures below 40 deg F (4.4 deg C) during application and for 24 hours after application.

END OF SECTION 071616

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Polyisocyanurate foam-plastic board.
2. Glass-fiber blanket.
3. Mineral-wool blanket.
4. Mineral-wool board.

B. Related Requirements:

1. Section 075216.13 "Styrene-Butadiene-Styrene (SBS) Modified Bituminous Membrane Roofing, Cold Applied" for insulation specified as part of roofing construction.
2. Section 092400 "Cement Plastering" for sound attenuation blanket used as acoustic insulation.
3. Section 092900 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.

2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.2 REGULATORY REQUIREMENTS

A. All insulation provided for use on this project shall be identified as required by Section 12-13-1557 of the California Referenced Standards Code (Part 12, Title 24, C.C.R.); Chapter 12-13 "Standards For Insulating Material", (See Part 6, Title 24, C.C.R.); Department Of Consumer Affairs, Bureau of Home Furnishings and Thermal Insulation; Article 3: "Standards for Insulating Material".

2.3 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Thermal Insulation, Tier 1: Comply with the following standards per CGBC Section A5.504.4.8:

1. Chapters 12-13 (Standards for Insulating Material) in Title 24, Part 12, the California Referenced Standards Code.
2. The VOC-emission limits defined in 2009 CHPS criteria and listed in its High Performance Products Database.
3. California Department of Public Health 2010 Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1, February 2010 (also known as Specification 01350).

C. Thermal Insulation, Tier 2: Thermal insulation, No-added Formaldehyde. Install thermal insulation which complies with Tier 1 plus does not contain any added formaldehyde per CGBC Section A5.504.4.8.1.

D. Provide glass-fiber blanket insulation as follows:

1. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05 ppm formaldehyde.
2. Recycled Content: Recycled content not less than 20 percent.

E. Provide mineral-wool blanket insulation as follows:

1. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05 ppm formaldehyde.
2. Recycled Content: Recycled content not less than 20 percent.

F. Provide mineral-wool board insulation as follows:

1. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05 ppm formaldehyde.
2. Recycled Content: Recycled content not less than 20 percent.

2.4 POLYISOCYANURATE FOAM-PLASTIC BOARD

A. Polyisocyanurate Board, Foil Faced: ASTM C1289, foil faced, Type I, Class 1, Grade 3.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Hunter Panels; Xci Class A, or a comparable product by one of the following:

a. Atlas EPS; a Division of Atlas Roofing Corporation.
b. Atlas Roofing Corporation.
c. Carlisle Coatings & Waterproofing Inc.
d. Dow Chemical Company (The).
e. Firestone Building Products.
f. Rmax, Inc.

2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.5 GLASS-FIBER BLANKET

A. Glass-Fiber Blanket, Unfaced: ASTM C665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E84; passing ASTM E136 for combustion characteristics.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. CertainTeed Corporation.
b. Johns Manville; a Berkshire Hathaway company.
c. Knauf Insulation.
d. Owens Corning.

2.6 MINERAL-WOOL BLANKETS

A. Mineral-Wool Blanket, Unfaced: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E84; passing ASTM E136 for combustion characteristics.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Johns Manville; a Berkshire Hathaway company.
b. Rockwool International.
c. Thermafiber, Inc.; an Owens Corning company.

2.7 MINERAL-WOOL BOARD

A. Mineral-Wool Board, Type III, Faced: ASTM C612, Type III; faced on one side with foil-scrim or foil-scrim-polyethylene vapor retarder; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E84. Nominal density of 8 lb/cu. ft. (128 kg/cu. m).

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Johns Manville; a Berkshire Hathaway company.
b. Rockwool International.
c. Thermafiber, Inc.; an Owens Corning company.

2.8 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Foam-Plastic Board Insulation: Install with mechanical fasteners as recommended by manufacturer. Fit insulation with edges butted tightly in both directions. Press units firmly against substrates.

C. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3 inch (76 mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
5. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly. Provide mineral-fiber insulation to comply with requirements of perimeter fire-containment system.

D. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.4 INSTALLATION OF CURTAIN-WALL INSULATION

A. Install board insulation in curtain-wall construction according to curtain-wall manufacturer's written instructions.

1. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated on Drawings between insulation and glass.
2. Install insulation to fit snugly without bowing.

3.5 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

This page intentionally left blank.

SECTION 072500 - WEATHER BARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Building paper.
2. Self-adhering, high-temperature sheet underlayment.
3. Flexible flashing.
4. Drainage material.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show details of building paper, self-adhering high-temperature sheet underlayment, and drainage material at terminations, openings, and penetrations. Show details of flexible flashing applications.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For building paper, self-adhering high-temperature sheet underlayment, flexible flashing, and drainage material from ICC-ES.

PART 2 - PRODUCTS

2.1 WATER-RESISTIVE BARRIER

A. Building Paper: Water-vapor-permeable, asphalt-saturated kraft building paper that complies with ICC-ES AC38, Grade D; except with water-resistance rating not less than 1 hour.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Fortifiber Building Systems Group; Super Jumbo Tex 60 Minute, or comparable product by another manufacturer.

B. Self-Adhering, High-Temperature Sheet Underlayment: Not less than 30 mils (0.76 mm) thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer in accordance with underlayment manufacturer's written instructions.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Carlisle Residential; a division of Carlisle Construction Materials; WIP 300HT.
    b. Drexel Metals; MetShield.
    c. GCP Applied Technologies Inc.; Ultra.
    d. Henry Company; Blueskin PE200 HT.
    e. Kirsch Building Products, LLC; Sharkskin Ultra SA.
    f. Owens Corning; WeatherLock Metal High Temperature Underlayment.

2. Thermal Stability: Stable after testing at 240 deg F (116 deg C) or higher; ASTM D1970.
3. Low-Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C) or lower; ASTM D1970.

2.2 FLEXIBLE FLASHING

A. General: Contractor may use either butyl rubber flashing or rubberized-asphalt flashing at his option.

B. Butyl Rubber Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.030 inch (0.76 mm).

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. DuPont Safety & Construction.
    b. GCP Applied Technologies Inc.
    c. Protecto Wrap Company.
    d. Raven Industries, Inc.
    e. TYPAR.

2. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

C. Rubberized-Asphalt Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.030 inch (0.8 mm).

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Advanced Building Products Inc.
    b. Carlisle Coatings & Waterproofing Inc.
    c. Fiberweb, Clark Hammerbeam Corp.
    d. Fortifiber Building Systems Group.
    e. GCP Applied Technologies Inc.
    f. MFM Building Products Corp.
    g. Polyguard Products, Inc.
    h. TYPAR.
    i. Wire-Bond.

2. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

D. Primer for Flexible Flashing: Product recommended in writing by flexible flashing manufacturer for substrate.

E. Nails and Staples: Product recommended in writing by flexible flashing manufacturer and complying with ASTM F1667.

2.3 DRAINAGE MATERIAL

A. Drainage Material: Product shall maintain a continuous open space between wall sheathing and foam-plastic board insulation.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Fortifiber Building Systems Group; WeatherSmart Drainable, or comparable product by one of the following:

   a. CavClear/Archovations, Inc.
   b. DuPont Safety & Construction.
   c. Insulfoam - a division of Carlisle Construction Materials Inc.
   d. Keene Building Products.
   e. Mortar Net Solutions.
   f. Stuc-O-Flex International, Inc.
   g. TYPAR.

2. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

PART 3 - EXECUTION

3.1 WATER-RESISTIVE BARRIER INSTALLATION

A. Cover foam-plastic board insulation with water-resistive barrier as follows:

1. Cut back barrier 1/2 inch (13 mm) on each side of the break in supporting members at expansion- or control-joint locations.
2. Apply barrier to cover vertical flashing with not less than 4 inch (100 mm) overlap unless otherwise indicated.

B. Building Paper: Apply horizontally with not less than 2 inch (50 mm) overlap and not less than 6 inch (150 mm) end lap; fasten to sheathing with galvanized staples or roofing nails.

1. Install building paper to comply with manufacturer's written instructions.
2. Cover exposed exterior surface of foam-plastic board insulation with two layers of building paper securely fastened to framing immediately after foam-plastic board insulation is installed where cement plaster will be installed and where indicated on Drawings.

C. Self-Adhering, High-Temperature Sheet Underlayment:

1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
2. Prime substrate if recommended by self-adhering, high-temperature sheet underlayment manufacturer.
3. Comply with temperature restrictions of self-adhering, high-temperature sheet underlayment manufacturer for installation; use primer for installing self-adhering, high-temperature sheet underlayment at low temperatures.

4. Install in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered not less than 24 inches (600 mm) between courses.
5. Overlap side edges not less than 3-1/2 inches (90 mm).
6. Roll end laps and side edges with roller.
7. Cover self-adhering, high-temperature sheet underlayment within 14 days.
8. Install self-adhering, high-temperature sheet underlayment to comply with manufacturer's written instructions.
9. Cover exposed exterior surface of foam-plastic board insulation with one layer of self-adhering, high-temperature sheet underlayment immediately after foam-plastic board insulation is installed where composite metal panels will be installed and where indicated on Drawings.

3.2 FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing to comply with manufacturer's written instructions.

1. Prime substrates as recommended by flashing manufacturer.
2. Lap seams and junctures with other materials not less than 4 inches (100 mm) except that at flashing flanges of other construction, laps need not exceed flange width.
3. Lap flashing over water-resistive barrier at bottom and sides of openings.
4. Lap water-resistive barrier over flashing at heads of openings.
5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.
6. Install flexible flashing at all locations recommended by manufacturer, at all horizontal projections, and where indicated on Drawings.

3.3 DRAINAGE MATERIAL INSTALLATION

A. Install drainage material to comply with manufacturer's written instructions.

1. Cover exposed exterior surface of wall sheathing with one layer of drainage material securely fastened to framing immediately after sheathing is installed.

END OF SECTION 072500

SECTION 074213.23 - METAL COMPOSITE MATERIAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal composite material wall panels.
2. Panel mounting system including anchors, shims, furring, fasteners, gaskets and sealants, related flashing adapters, and masking (as required) for a complete watertight installation.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, metal composite material panel Installer, metal composite material panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal composite material panels, including installers of doors, windows, and louvers.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal composite material panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal composite material panels.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for metal composite material panel assembly during and after installation.
8. Review procedures for repair of panels damaged after installation.
9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal composite material panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.
2. Distinguish between factory and field assembled work.
3. Accessories: Include details of the flashing, trim and anchorage, at a scale of not less than 1-1/2 inches per 12 inches (1:10).

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Metal Composite Material Panels: 12 inches (305 mm) long by actual panel width. Include fasteners, closures, and other metal composite material panel accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, tests performed by a qualified testing agency.

C. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal composite material panels to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 MOCKUPS

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical metal composite material panel assembly as shown on Drawings or, if not shown on the Drawings, as directed by the Architect, including corners, soffits, supports, attachments, and accessories.

a. Include four-way joint for metal composite material panels.

2. Water-Spray Test: Conduct water-spray test of mockup of metal composite material panel assembly, testing for water penetration according to AAMA 501.2.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal composite material panels, and other manufactured items so as not to be damaged or deformed. Package metal composite material panels for protection during transportation and handling.

B. Unload, store, and erect metal composite material panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal composite material panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal composite material panels to ensure dryness, with positive slope for drainage of water. Do not store metal composite material panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal composite material panels during installation.

1.10 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal composite material panels to be performed according to manufacturers' written instructions and warranty requirements.

1.11 COORDINATION

A. Coordinate metal composite material panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.12 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal composite material panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal composite material panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

   a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain all components of metal composite material wall panel system, including anchors, shims, furring, fasteners, gaskets and sealants, related flashing adapters, and accessories, from metal composite material wall panel manufacturer or manufacturer approved by metal composite material wall panel manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal composite material panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E330:

   1. Wind Loads: As indicated on Drawings.
   2. Other Design Loads: As indicated on Drawings.
   3. Deflection Limits: For wind loads, no greater than 1/240 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E283 at the following test-pressure difference:

   1. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa).

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:

   1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

   1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.3 METAL COMPOSITE MATERIAL WALL PANELS

A. Metal Composite Material Wall Panel Systems: Provide factory-formed and -assembled, metal composite material wall panels fabricated from two metal facings that are bonded to a solid, extruded thermoplastic core;

formed into profile for installation method indicated. Include attachment assembly components, panel stiffeners, and accessories required for weathertight system.

1. Basis-of-Design Product: Subject to compliance with requirements, provide ALUCOBOND; 3A Composites USA, Inc; Alucobond Plus, or a comparable product by one of the following:

    a. Alcoa Architectural Products (USA).
    b. Alcotex Inc.
    c. Alfrex - Unience USA, Inc.
    d. ALPOLIC Materials; Mitsubishi Chemical Composites.
    e. Alucoil North America.
    f. Citadel Architectural Products, Inc.
    g. Protean Construction Products, Inc.
    h. SAF (Southern Aluminum Finishing Company, Inc.).

B. Aluminum-Faced Composite Wall Panels: Formed with 0.0200 inch (0.51 mm) thick, coil-coated aluminum sheet facings.

1. Panel Thickness: 0.157 inch (4 mm).
2. Core: Fire retardant.
3. Exterior Finish: Three-coat fluoropolymer.

    a. Color: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

C. Attachment Assembly Components: Formed from extruded aluminum.

D. Attachment Assembly: Manufacturer's standard.

2.4 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet ASTM A653/A653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A792/A792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal composite material panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal composite material panels unless otherwise indicated.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal composite material panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal composite material panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal composite material panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal composite material panels and remain weathertight; and as recommended in writing by metal composite material panel manufacturer.

2.5 FABRICATION

A. General: Fabricate and finish metal composite material panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Fabricate metal composite material panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.6 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Aluminum Panels and Accessories:

1. Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal composite material panel supports, and other conditions affecting performance of the Work.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal composite material wall panel manufacturer.
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal composite material wall panel manufacturer.

a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and assemblies penetrating metal composite material panels to verify actual locations of penetrations relative to seam locations of metal composite material panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal composite material panel manufacturer's written recommendations.

3.3 METAL COMPOSITE MATERIAL PANEL INSTALLATION

A. General: Install metal composite material panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor metal composite material panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal composite material panels.
2. Flash and seal metal composite material panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal composite material panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal composite material panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal composite material panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal composite material panel manufacturer.

D. Attachment Assembly, General: Install attachment assembly required to support metal composite material wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.

1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.

E. Installation: Attach metal composite material wall panels to supports at locations, spacings, and with fasteners recommended by manufacturer to achieve performance requirements specified.

1. Wet Seal Systems: Seal horizontal and vertical joints between adjacent metal composite material wall panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Section 079200 "Joint Sealants."

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal composite material panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal composite material panel manufacturer; or, if not indicated, provide types recommended in writing by metal composite material panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at not more than 10 feet (3 m) with no joints allowed within 24 inches (605 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant (concealed within joints).

3.4 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal composite material wall panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), non-accumulative, on level, plumb, and location lines as indicated, and within 1/8 inch (3 mm) offset of adjoining faces and of alignment of matching profiles.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing agency to perform field tests and inspections.

B. Water-Spray Test: After installation, test area of assembly as shown on Drawings or, if not shown on the Drawings, as directed by the Architect for water penetration according to AAMA 501.2.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal composite material wall panel installation, including accessories.

D. Metal composite material wall panels will be considered defective if they do not pass test and inspections.

E. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

F. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal composite material panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal composite material panel installation, clean finished surfaces as recommended by metal composite material panel manufacturer. Maintain in a clean condition during construction.

B. After metal composite material panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal composite material panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213.23

This page intentionally left blank.

SECTION 075419 - POLYVINYL-CHLORIDE (PVC) ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Adhered polyvinyl chloride (PVC) roofing system.
2. Roof insulation.
3. Cover board.
4. Walkways.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking; and for wood-based, structural-use roof deck panels.
2. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
3. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
4. Section 221423 "Storm Drainage Piping Specialties" for roof drains.

1.3 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D1079 and glossary in NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.

1.4 PREINSTALLATION MEETINGS

A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.

6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

B. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:

1. Layout and thickness of insulation.
2. Base flashings and membrane terminations.
3. Flashing details at penetrations.
4. Tapered insulation thickness and slopes.
5. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

C. Samples for Verification: For the following products:

1. Roof membrane and flashing, of color required.
2. Walkway pads or rolls, of color required.

D. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Manufacturer Certificates:

1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

    a. Submit evidence of compliance with performance requirements.

2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.

C. Product Test Reports: For roof membrane and insulation, tests performed by independent qualified testing agency indicating compliance with specified requirements.

D. Evaluation Reports: For components of roofing system, from ICC-ES.

E. Field quality-control reports.

F. Sample Warranties: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is UL listed and listed in FM Approvals' RoofNav for roofing system identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.10 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes roof membrane, base flashings, roof insulation, fasteners, cover boards, walkway products, and other components of roofing system.
2. Warranty Period: 20 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as roof membrane, base flashings, roof insulation, fasteners, cover boards, walkway products, and other components of roofing system for the following warranty period:

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain components for roofing system including roof membrane, base flashing, roof insulation, fasteners, cover boards, walkway products, and other components of roofing system from roof membrane manufacturer or manufacturers approved by roof membrane manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings shall remain watertight.

1. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746, ASTM D4272/D4272M, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

C. FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials shall comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and shall be listed in

FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.

1. Fire/Windstorm Classification: Class 1A-90.
2. Hail-Resistance Rating: MH.

D. Energy Performance: Roofing system shall have an initial solar reflectance of not less than 0.70 and an emissivity of not less than 0.75 when tested according to CRRC-1.

E. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.3 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Recycled Content of Roof Membrane: Postconsumer recycled content plus preconsumer recycled content not less than 10 percent.

C. Finish Material Pollutant Control: Finish materials shall comply with CGBC Sections 5.504.4.1 through 5.504.4.6 per CGBC Section 5.504.4.

1. Adhesives, Sealants, and Caulks: Adhesives, sealants, and caulks used on the project shall meet the requirements of the following standards per CGBC Section 5.504.4.1:

    a. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in CBC Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products specified in subparagraph below.
    b. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

2. Adhesives shall comply with maximum VOC limits listed in CGBC Table 5.504.4.1.
3. Sealants and sealant primers shall comply with maximum VOC limits listed in CGBC Table 5.504.4.2.

D. VOC Content: Adhesives shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Drywall and Panel Adhesives: 50 g/L.
2. Multipurpose Construction Adhesives: 70 g/L.
3. Single-Ply Roof Membrane Adhesives: 250 g/L.
4. Drywall and Panel Adhesives: 50 g/L.
5. Other Adhesive Not Specifically Listed: 50 g/L.
6. PVC Welding Adhesives: 510 g/L.
7. Adhesive Primer for Plastic: 550 g/L.
8. Contact Adhesive: 80 g/L.

9. Plastic Foam Adhesives: 50 g/L.
10. Fiberglass Adhesives: 80 g/L.

E. VOC Content: Sealants and sealant primers shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Architectural Sealants: 250 g/L.
2. Nonmembrane Roof Sealants: 300 g/L.
3. Single-Ply Roof Membrane Sealants: 450 g/L.
4. Architectural Sealant Primers for Nonporous Substrates: 250 g/L.
5. Architectural Sealant Primers for Porous Substrates: 775 g/L.

F. Adhesives: Do not use adhesives that contain urea formaldehyde.

G. Low-Emitting Materials: Adhesives shall comply with the requirements of authorities having jurisdiction.

H. Low-Emitting Materials: Sealants and sealant primers shall comply with the requirements of authorities having jurisdiction.

2.4 POLYVINYL CHLORIDE (PVC) ROOFING

A. PVC Sheet: ASTM D4434/D4434M, Type II, glass-fiber reinforced, felt backed.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Sika Sarnafil; Sarnafil G410 EnergySmart Roof Membrane, or a comparable product by another manufacturer.
2. Linear Dimensional Change (percent) ASTM D 1204: 0.02 maximum.
3. Weight Change After Immersion in Water (percent) ASTM D 570: 2.0 maximum.
4. Minimum Elongation break ASTM D 751:

    a. Machine Direction: 250 percent.
    b. Cross Machine Direction: 220 percent.

5. Minimum Thickness, Less Felt Backing, ASTM D 751: Not less than 60 mils (1.5 mm) (nominal sheets not allowed).
6. Exposed Face Color: EnergySmart White.
7. Initial/3-Year Aged Reflectance ASTM C 1549: 83 percent/70 percent.
8. Initial/3-Year Aged Thermal Emittance ASTM C 1371: 0.90/0.86.
9. Initial/3-Year Aged Solar Reflectance Index (SRI) ASTM E 1980: 104/85.

2.5 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.

B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as PVC sheet.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Sika Sarnafil; Sarnafil G410 Flashing Membrane, or a comparable product by another manufacturer.
2. Minimum Thickness, ASTM D 751: Not less than 60 mils (1.5 mm).

C. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.

D. Water-Based, Fabric-Backed Membrane Adhesive: Roofing system manufacturer's standard water-based, cold-applied adhesive formulated for compatibility and use with fabric-backed membrane roofing.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Sika Sarnafil; Sikaplan Water Based Membrane Adhesive, or a comparable product by another manufacturer.

E. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.

F. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.

G. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.6 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by PVC roof membrane manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated, approved for use in FM Approvals' RoofNav listed roof assemblies.

B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 3, felt or glass-fiber mat facer on both major surfaces.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Sika Sarnafil; Sarnatherm Insulation (25psi), or comparable product by another manufacturer.
2. Compressive Strength: 25 psi (172 kPa).
3. Thickness: Not less than that required to achieve R-30 or as indicated on Drawings.

C. Tapered Insulation: Provide factory-tapered insulation boards.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Sika Sarnafil; Sarnatherm Insulation Tapered (25psi), or a comparable product by another manufacturer.
2. Material: Match roof insulation.
3. Minimum Thickness: 1/4 inch (6.35 mm).
4. Slope:

a. Roof Field: 1/4 inch per foot (1:48) unless otherwise indicated on Drawings.
b. Saddles and Crickets: 1/2 inch per foot (1:24) unless otherwise indicated on Drawings.

2.7 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Sika Sarnafil; Sarnacol AD Board Adhesive, or a comparable product by another manufacturer.
2. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.

D. Cover Board: ASTM C1177/C1177M, glass-mat, water-resistant gypsum board or ASTM C1278/C1278M fiber-reinforced gypsum board.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Georgia-Pacific Gypsum LLC; Dens Deck or a comparable product by another manufacturer.

2. Thickness: Not less than 1/4 inch (6 mm).
3. Surface Finish: Unprimed.

2.8 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway rolls, not less than 96 mils (2.4 mm) thick and acceptable to roofing system manufacturer.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Sika Sarnafil; Sarnatred-V, or a comparable product by another manufacturer.
2. Size: Approximately 39 inches (1 m) by 50 feet (15 m).
3. Color: Light gray.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Perform fastener-pullout tests according to roof system manufacturer's written instructions.

1. Submit test result within 24 hours of performing tests.

a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

3.3 INSTALLATION OF ROOFING, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions, FM Approvals' RoofNav assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.4 INSTALLATION OF INSULATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.

B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Installation Over Metal Decking:

1. Install base layer of insulation with end joints staggered not less than 12 inches (305 mm) in adjacent rows and with long joints continuous at right angle to flutes of decking.

a. Locate end joints over crests of decking.
b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
c. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches (610 mm).

1) Trim insulation so that water flow is unrestricted.

e. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
f. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
g. Mechanically attach base layer of insulation using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.

1) Fasten insulation according to requirements in FM Approvals' RoofNav for specified Windstorm Resistance Classification.

2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches (305 mm) from previous layer of insulation.

a. Install with long joints continuous and with end joints staggered not less than 12 inches (305 mm) in adjacent rows.
b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
c. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches (610 mm).

1) Trim insulation so that water flow is unrestricted.

e. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
f. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
g. Adhere upper layers of insulation and tapered insulation to substrate using adhesive according to FM Approvals' RoofNav assembly requirements and FM Global Property Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification, as follows:

1) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

3.5 INSTALLATION OF COVER BOARDS

A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below not less than 6 inches (150 mm) in each direction.

1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
2. At internal roof drains, conform to slope of drain sump.

a. Trim cover board so that water flow is unrestricted.

3. Cut and fit cover board tight to nailers, projections, and penetrations.
4. Adhere cover board to substrate using adhesive according to FM Approvals' RoofNav assembly requirements and FM Global Property Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification, as follows:

a. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining cover board in place.

3.6 INSTALLATION OF ADHERED ROOFING

A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.

B. Unroll roof membrane and allow to relax before installing.

C. Start installation of roofing in presence of roofing system manufacturer's technical personnel and Owner's testing and inspection agency.

D. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

E. Fabric-Backed Roof Membrane Adhesive: Apply to substrate at rate required by manufacturer, and install fabric-backed roof membrane.

1. Install membrane immediately into adhesive, avoiding any air entrapment; do not allow adhesive to dry.
2. Roll membrane into wet adhesive.
3. Do not apply to splice area of roof membrane.

F. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeter of roofing.

G. Apply roof membrane with side laps shingled with slope of roof deck where possible.

H. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roof membrane and sheet flashings according to roofing system manufacturer's written instructions to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roof membrane and sheet flashings.
2. Verify field strength of seams not less than twice daily, and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.

I. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.7 INSTALLATION OF BASE FLASHING

A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.8 INSTALLATION OF WALKWAYS

A. Flexible Walkways: Install walkway products according to manufacturer's written instructions.

1. Install flexible walkways at the following locations:

   a. Locations indicated on Drawings.
   b. As required by roof membrane manufacturer's warranty requirements.

2. Provide 6 inch (76 mm) clearance between adjoining pads.
3. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to inspect substrate conditions, surface preparation, roof membrane application, sheet flashings, protection, and drainage components, and to furnish reports to Architect.

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.

C. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.10 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.11 ROOFING INSTALLER'S WARRANTY

A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: <**Insert name of Owner**>.
2. Address: <**Insert address**>.
3. Building Name/Type: <**Insert information**>.
4. Address: <**Insert address**>.
5. Area of Work: <**Insert information**>.
6. Acceptance Date: _____.
7. Warranty Period: <**Insert time**>.

8. Expiration Date: _____.

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period Roofing Installer will, at Roofing Installer's own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

    a. lightning;
    b. peak gust wind speed exceeding <**Insert mph (m/s)**>;
    c. fire;
    d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
    e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
    f. vapor condensation on bottom of roofing; and
    g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents,

regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION 075419

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Formed low-slope roof sheet metal fabrications.
2. Formed wall sheet metal fabrications.
3. Formed equipment support flashing.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 074213.23 "Metal Composite Material Wall Panels" for sheet metal flashing and trim integral with metal wall panels.
3. Section 075216.15 "SBS Modified Bituminous Membrane Roofing, Cold-Applied" for installation of sheet metal flashing and trim integral with roofing.

1.3 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
3. Review requirements for insurance and certificates if applicable.
4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each of the following

1. Underlayment materials.
2. Elastomeric sealant.
3. Butyl sealant.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of roof-penetration flashing.
9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.
10. Include details of special conditions.
11. Include details of connections to adjoining work.
12. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches (1:10).

C. Samples for Verification: For each type of exposed finish.

1. Sheet Metal Flashing: 12 inches (300 mm) long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches (300 mm) long and in required profile. Include fasteners and other exposed accessories.
3. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

B. Special warranty.

1.8 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
2. Protect stored sheet metal flashing and trim from contact with water.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.10 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. Sheet Metal Standard for Copper: Comply with CDA's "Copper in Architecture Handbook." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

D. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:

1. Design Pressure: As indicated on Drawings.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Recycled Content of Steel Products: Recycled content not less than 20 percent.

C. Finish Material Pollutant Control: Finish materials shall comply with CGBC Sections 5.504.4.1 through 5.504.4.6 per CGBC Section 5.504.4.

1. Adhesives, Sealants, and Caulks: Adhesives, sealants, and caulks used on the project shall meet the requirements of the following standards per CGBC Section 5.504.4.1:

a. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in CBC Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products specified in subparagraph below.
b. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

2. Sealants and sealant primers shall comply with maximum VOC limits listed in CGBC Table 5.504.4.2.

D. VOC Content: Sealants and sealant primers shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Architectural Sealants: 250 g/L.
2. Architectural Sealant Primers for Nonporous Substrates: 250 g/L.
3. Architectural Sealant Primers for Porous Substrates: 775 g/L.

E. Low-Emitting Materials: Sealants and sealant primers shall comply with the requirements of authorities having jurisdiction.

F. Low-Emitting Materials: Paints and coatings shall comply with the requirements of authorities having jurisdiction.

2.3 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 or H01 temper.

1. Nonpatinated, Exposed Finish: Mill.

C. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet in accordance with ASTM A653/A653M, G90 (Z275) coating designation or aluminum-zinc alloy-coated steel sheet in accordance with ASTM A792/A792M, Class AZ50 (Class AZM150) coating designation, Grade 40 (Grade 275); prepainted by coil-coating process to comply with ASTM A755/A755M.

1. Surface: Smooth, flat.
2. Exposed Coil-Coated Finish:

a. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

3. Color: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.
4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil (0.013 mm).

D. Zinc Sheet: Zinc, 99 percent pure, alloyed with 0.08 to 1.00 percent copper, 0.06 to 0.20 percent titanium, and not more than 0.015 percent aluminum; with manufacturer's standard factory-applied, flexible, protective back coating.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Jarden Zinc Products.
b. Rheinzink America Inc.
c. Umicore Building Products USA, Inc.

2. Finish: Bright rolled.

2.4 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet Underlayment: Not less than 30 mils (0.76 mm) thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer in accordance with underlayment manufacturer's written instructions.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:

a. Carlisle Residential; a division of Carlisle Construction Materials; WIP 300HT.
b. Drexel Metals; MetShield.
c. GCP Applied Technologies Inc.; Ultra.
d. Henry Company; Blueskin PE200 HT.
e. Kirsch Building Products, LLC; Sharkskin Ultra SA.
f. Owens Corning; WeatherLock Metal High-Temperature Underlayment.

2. Thermal Stability: Stable after testing at 240 deg F (116 deg C) or higher; ASTM D1970.
3. Low-Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C) or lower; ASTM D1970.

B. Slip Sheet: Rosin-sized building paper, not less than 3 lb/100 sq. ft. (0.16 kg/sq. m).

2.5 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.

2. Fasteners for Copper Sheet: Copper, hardware bronze or passivated Series 300 stainless steel.
3. Fasteners for Zinc-Coated (Galvanized) and Aluminum-Zinc Alloy-Coated] Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329.
4. Fasteners for Zinc Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.

D. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

2.6 FABRICATION, GENERAL

A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.

1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:

1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8 inch (3 mm) offset of adjoining faces and of alignment of matching profiles.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

G. Seams:

1. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

H. Do not use graphite pencils to mark metal surfaces.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Copings: Fabricate in not less than 96 inch (2400 mm) long, but not more than 12 foot (3.6 m) long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Drill elongated holes for fasteners on interior leg. Miter corners, fasten and seal watertight. Shop fabricate interior and exterior corners.

1. Coping Profile: As indicated on Drawings.
2. Joint Style: Butted with expansion space and 12 inch (300 mm) wide, concealed backup plate.
3. Fabricate from one of the following materials:

    a. Galvanized Steel: 0.0396 inch (1.01 mm) thick (20 gage nominal).
    b. Aluminum-Zinc Alloy-Coated Steel: 0.0396 inch (1.01 mm) thick (20 gage nominal).

B. Base Flashing: Shop fabricate interior and exterior corners.

1. Fabricate from one of the following materials:

    a. Galvanized Steel: 0.0276 inch (0.70 mm) thick (24 gage nominal).
    b. Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch (0.70 mm) thick (24 gage nominal).

C. Counterflashing: Shop fabricate interior and exterior corners.

1. Fabricate from one of the following materials:

    a. Galvanized Steel: 0.0217 inch (0.55 mm) thick (26 gage nominal).
    b. Aluminum-Zinc Alloy-Coated Steel: 0.0217 inch (0.55 mm) thick (26 gage nominal).

D. Flashing Receivers:

1. Fabricate from one of the following materials:

    a. Galvanized Steel: 0.0217 inch (0.55 mm) thick (26 gage nominal).
    b. Aluminum-Zinc Alloy-Coated Steel: 0.0217 inch (0.55 mm) thick (26 gage nominal).

E. Roof-Penetration Flashing:

1. Fabricate from one of the following materials:

    a. Galvanized Steel: 0.0276 inch (0.70 mm) thick (24 gage nominal).
    b. Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch (0.70 mm) thick (24 gage nominal).

F. Roof-Drain Flashing:

1. Fabricate from one of the following materials:

    a. Copper: 12 oz./sq. ft. (0.41 mm thick).
    b. Zinc: 0.032 inch (0.80 mm) thick.

2.8 WALL SHEET METAL FABRICATIONS

A. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches (100 mm) beyond wall openings. Form head and sill flashing with 2 inch (50 mm) high, end dams.

1. Fabricate from one of the following materials:

    a. Galvanized Steel: 0.0217 inch (0.55 mm) thick (26 gage nominal).
    b. Aluminum-Zinc Alloy-Coated Steel: 0.0217 inch (0.55 mm) thick (26 gage nominal).

2.9 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing:

1. Fabricate from one of the following materials:

a. Galvanized Steel: 0.0276 inch (0.70 mm) thick (24 gage nominal).
b. Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch (0.70 mm) thick (24 gage nominal).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT

A. Self-Adhering, High-Temperature Sheet Underlayment:

1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
2. Prime substrate if recommended by self-adhering, high-temperature sheet underlayment manufacturer.
3. Comply with temperature restrictions of self-adhering, high-temperature sheet underlayment manufacturer for installation; use primer for installing self-adhering, high-temperature sheet underlayment at low temperatures.
4. Install in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered not less than 24 inches (600 mm) between courses.
5. Overlap side edges not less than 3-1/2 inches (90 mm).
6. Roll end laps and side edges with roller.
7. Cover self-adhering, high-temperature sheet underlayment within 14 days.
8. Install self-adhering, high-temperature sheet underlayment to comply with manufacturer's written instructions.

B. Install slip sheet, wrinkle free, over self-adhering, high-temperature sheet underlayment before installing sheet metal flashing and trim.

1. Install in shingle fashion to shed water, with end laps of not less than 4 inches (100 mm).
2. Overlap side edges not less than 4 inches (100 mm).

3.3 INSTALLATION, GENERAL

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.

1. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
5. Provide continuous cleats. Install each cleat as indicated on Drawings, with fasteners spaced not more than 6 inches (150 mm) o.c. Bend tabs over fasteners.
6. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
7. Do not torch cut sheet metal flashing and trim.
8. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install self-adhering, high-temperature sheet underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.

1. Space movement joints at not more than 10 feet (3 m) with no joints within 24 inches (600 mm) of corner or intersection.
2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
3. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws and other substrates not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated.

a. Embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant.
b. Form joints to completely conceal sealant.
c. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way.
d. Adjust setting proportionately for installation at higher ambient temperatures.

1) Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).

2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.4 INSTALLATION OF ROOF FLASHINGS

A. Install sheet metal flashing and trim to comply with performance requirements,sheet metal manufacturer's written installation instructions, and cited sheet metal standard.

1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Copings:

1. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated.

a. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate as indicated on Drawings, with fasteners spaced not more than 6 inches (150 mm) o.c.
b. Anchor interior leg of coping with washers and screw fasteners through slotted holes with fasteners spaced not more than 16 inches (400 mm) o.c.

C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending not less than 4 inches (100 mm) over base flashing. Install stainless steel draw band and tighten.

D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.

1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
2. Extend counterflashing not less than 4 inches (100 mm) over base flashing.
3. Lap counterflashing joints not less than 4 inches (100 mm).
4. Secure in waterproof manner by means of snap-in installation and sealant or lead wedges and sealant unless otherwise indicated.

E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric or butyl sealant and clamp flashing to pipes that penetrate roof.

3.5 INSTALLATION OF WALL FLASHINGS

A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend not less than 4 inches (100 mm) beyond wall openings.

3.6 INSTALLATION OF MISCELLANEOUS FLASHING

A. Equipment Support Flashing:

1. Coordinate installation of equipment support flashing with installation of roofing and equipment.
2. Weld or seal flashing with elastomeric sealant to equipment support member.

3.7 INSTALLATION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8 inch (3 mm) offset of adjoining faces and of alignment of matching profiles.

3.8 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

D. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.

E. Maintain sheet metal flashing and trim in clean condition during construction.

F. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 076200

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.
3. Penetrations in smoke barriers.

B. Related Requirements:

1. Section 078443 "Joint Firestopping" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Approval according to FM Approval 4991, "Approval Standard for Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

B. Installation Responsibility: Assign installation of penetration firestopping systems and joint firestopping systems in Project to a single qualified installer.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.9 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

C. Notify Owner's testing agency not less than seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain penetration firestopping systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:

    a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.

        1) UL in its "Fire Resistance Directory."
        2) Intertek Group in its "Directory of Listed Building Products."
        3) FM Approval in its "Approval Guide."

2.3 REGULATORY REQUIREMENTS

A. Marking and Identification: Where there is an accessible concealed floor, floor-ceiling, or attic space, fire walls, fire barriers, fire partitions, smoke barriers, and smoke partitions or any other required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling in the concealed space per CBC Section 703.7. Such identification shall:

1. Be located within 15 feet (4572 mm) of the end of each wall and at intervals not exceeding 30 feet (9144 mm) measured horizontally along the wall or partition.
2. Include lettering not less than 3 inches (76 mm) in height with a minimum 3/8 inch (9.5 mm) stroke in a contrasting color incorporating the suggested wording "FIRE AND/OR SMOKE BARRIER – PROTECT ALL OPENINGS" or other wording.

2.4 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Finish Material Pollutant Control: Finish materials shall comply with CGBC Sections 5.504.4.1 through 5.504.4.6 per CGBC Section 5.504.4.

1. Adhesives, Sealants, and Caulks: Adhesives, sealants, and caulks used on the project shall meet the requirements of the following standards per CGBC Section 5.504.4.1:

    a. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in CBC Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products specified in subparagraph below.
    b. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

2. Adhesives shall comply with maximum VOC limits listed in CGBC Table 5.504.4.1.
3. Sealants and sealant primers shall comply with maximum VOC limits listed in CGBC Table 5.504.4.2.

C. VOC Content: Adhesives shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Multipurpose Construction Adhesives: 70 g/L.

D. VOC Content: Sealants and sealant primers shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Architectural Sealants: 250 g/L.
2. Architectural Sealant Primers for Nonporous Substrates: 250 g/L.
3. Architectural Sealant Primers for Porous Substrates: 775 g/L.

E. Low-Emitting Materials: Adhesives shall comply with the requirements of authorities having jurisdiction.

F. Low-Emitting Materials: Sealants and sealant primers shall comply with the requirements of authorities having jurisdiction.

2.5 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. 3M Fire Protection Products.
b. A/D Fire Protection Systems Inc.
c. Construction Solutions.
d. Grabber Construction Products.
e. Hilti, Inc.
f. HOLDRITE.
g. NUCO Inc.
h. Passive Fire Protection Partners.
i. RectorSeal.
j. Specified Technologies, Inc.
k. STC Sound Control.
l. Tremco, Inc.

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01 inch wg (2.49 Pa).

1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01 inch wg (2.49 Pa).

1. F-Rating: Not less than one hour, but not less than the fire-resistance rating of constructions penetrated.
2. T-Rating: Not less than one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.

D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30 inch wg (74.7 Pa).

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at and no more than 50 cfm (0.024 cu. m/s) cumulative total for any 100 sq. ft. (9.3 sq. m) at both ambient and elevated temperatures.

E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E84.

F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

1. Permanent forming/damming/backing materials.
2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.
6. Adhesives.
7. Sealants and sealant primers.

2.6 FILL MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.

E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

2.7 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

C. Install fill materials by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches (76 mm) high and with not less than 0.375 inch (9.5 mm) strokes.

1. Locate in accessible concealed floor, floor-ceiling, or attic space at not more than 15 feet (4.57 m) from end of wall and at intervals not more than 30 feet (9.14 m).

B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "WARNING - PENETRATION FIRESTOPPING - DO NOT DISTURB. NOTIFY BUILDING MANAGEMENT OF ANY DAMAGE."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E2174.

B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION 078413

SECTION 078443 - JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated constructions.
2. Joints at exterior curtain-wall/floor intersections.
3. Joints in smoke barriers.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.
2. Section 092216 "Non-Structural Metal Framing" for firestop tracks for metal-framed partition heads.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each joint firestopping system, for tests performed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Approvals according to FM Approvals 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

B. Installation Responsibility: Assign installation of joint firestopping systems and penetration firestopping systems in Project to a single qualified installer.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.9 COORDINATION

A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of joints to accommodate joint firestopping systems.

C. Notify Owner's testing agency not less than seven days in advance of joint firestopping installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain joint firestopping systems, for each kind of joint and construction condition indicated, through one source from a single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.

2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:

    a. Joint firestopping systems shall bear classification marking of a qualified testing agency.

        1) UL in its "Fire Resistance Directory."
        2) Intertek Group in its "Directory of Listed Building Products."

2.3 REGULATORY REQUIREMENTS

A. Marking and Identification: Where there is an accessible concealed floor, floor-ceiling, or attic space, fire walls, fire barriers, fire partitions, smoke barriers, and smoke partitions or any other required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling in the concealed space per CBC Section 703.7. Such identification shall:

1. Be located within 15 feet (4572 mm) of the end of each wall and at intervals not exceeding 30 feet (9144 mm) measured horizontally along the wall or partition.
2. Include lettering not less than 3 inches (76 mm) in height with a minimum 3/8 inch (9.5 mm) stroke in a contrasting color incorporating the suggested wording "FIRE AND/OR SMOKE BARRIER – PROTECT ALL OPENINGS" or other wording.

2.4 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Finish Material Pollutant Control: Finish materials shall comply with CGBC Sections 5.504.4.1 through 5.504.4.6 per CGBC Section 5.504.4.

1. Adhesives, Sealants, and Caulks: Adhesives, sealants, and caulks used on the project shall meet the requirements of the following standards per CGBC Section 5.504.4.1:

    a. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in CBC Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products specified in subparagraph below.
    b. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

2. Adhesives shall comply with maximum VOC limits listed in CGBC Table 5.504.4.1.
3. Sealants and sealant primers shall comply with maximum VOC limits listed in CGBC Table 5.504.4.2.

C. VOC Content: Adhesives shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Multipurpose Construction Adhesives: 70 g/L.

D. VOC Content: Sealants and sealant primers shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Architectural Sealants: 250 g/L.
2. Architectural Sealant Primers for Nonporous Substrates: 250 g/L.
3. Architectural Sealant Primers for Porous Substrates: 775 g/L.

E. Low-Emitting Materials: Adhesives shall comply with the requirements of authorities having jurisdiction.

F. Low-Emitting Materials: Sealants and sealant primers shall comply with the requirements of authorities having jurisdiction.

2.5 JOINT FIRESTOPPING SYSTEMS

A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E1966 or UL 2079.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. 3M Fire Protection Products.
b. A/D Fire Protection Systems Inc.
c. ClarkDietrich.
d. Grabber Construction Products.
e. Hilti, Inc.
f. Nelson Firestop; a brand of Emerson Industrial Automation.
g. NUCO Inc.
h. Passive Fire Protection Partners.
i. RectorSeal.
j. Rockwool International.
k. Specified Technologies, Inc.
l. Thermafiber, Inc.; an Owens Corning company.
m. Tremco, Inc.
n. Willseal LLC.

2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.

C. Joints at Exterior Curtain-Wall/Floor Intersections: Provide joint firestopping systems with rating determined per ASTM E2307.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. 3M Fire Protection Products.
b. ClarkDietrich.

c. Hilti, Inc.
d. Johns Manville; a Berkshire Hathaway company.
e. Nelson Firestop; a brand of Emerson Industrial Automation.
f. NUCO Inc.
g. RectorSeal.
h. Rockwool International.
i. Specified Technologies, Inc.
j. Thermafiber, Inc.; an Owens Corning company.
k. Tremco, Inc.

2. F-Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.

D. Joints in Smoke Barriers: Provide joint firestopping systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30 inch wg (74.7 Pa).

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. 3M Fire Protection Products.
b. A/D Fire Protection Systems Inc.
c. Hilti, Inc.
d. Nelson Firestop; a brand of Emerson Industrial Automation.
e. NUCO Inc.
f. Passive Fire Protection Partners.
g. RectorSeal.
h. Rockwool International.
i. Specified Technologies, Inc.
j. Thermafiber, Inc.; an Owens Corning company.
k. Tremco, Inc.
l. Willseal LLC.

2. L-Rating: Not exceeding 5.0 cfm/ft. (0.00775 cu. m/s x m) of joint at both ambient and elevated temperatures.

E. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.

F. Accessories: Provide components of joint firestopping systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Before installing joint firestopping systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:

1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install joint firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install elastomeric fill materials for joint firestopping systems by proven techniques to produce the following results:

1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches (76 mm) high and with not less than 0.375 inch (9.5 mm) strokes.

1. Locate in accessible concealed floor, floor-ceiling, or attic space at not more than 15 feet (4.57 m) from end of wall and at intervals not more than 30 feet (9.14 m).

B. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "WARNING - JOINT FIRESTOPPING - DO NOT DISTURB. NOTIFY BUILDING MANAGEMENT OF ANY DAMAGE."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E2393.

B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.

C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated joint firestopping systems immediately and install new materials to produce joint firestopping systems complying with specified requirements.

END OF SECTION 078443

This page intentionally left blank.

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Mildew-resistant joint sealants.
4. Butyl joint sealants.
5. Latex joint sealants.

B. Related Requirements:

1. Section 079219 "Acoustical Joint Sealants" for sealing joints in sound-rated construction.
2. Section 084113 "Aluminum-Framed Entrances and Storefronts" for structural and other glazing sealants.
3. Section 088000 "Glazing" for glazing sealants.
4. Section 321373 "Concrete Paving Joint Sealants" for sealing joints in paved roads, parking lots, walkways, and curbing.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2 inch (13 mm) wide joints formed between two 6 inch (150 mm) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and qualified testing agency.

B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

C. Product Test Reports: For each kind of joint sealant, for tests performed by a qualified testing agency.

D. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and substrate material to be tested:

1. Joint-sealant location and designation.
2. Manufacturer and product name.
3. Type of substrate material.
4. Proposed test.
5. Number of samples required.

E. Preconstruction Laboratory Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.

F. Field-Adhesion-Test Reports: For each sealant application tested.

G. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Adhesion Testing: Use ASTM C 794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Compatibility Testing: Use ASTM C 1087 to determine sealant compatibility when in contact with glazing and gasket materials.
3. Stain Testing: Use ASTM C 1248 to determine stain potential of sealant when in contact with porous substrates.

4. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
5. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
6. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
7. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 12 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.

1.8 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.9 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

2.2 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Finish Material Pollutant Control: Finish materials shall comply with CGBC Sections 5.504.4.1 through 5.504.4.6 per CGBC Section 5.504.4.

1. Adhesives, Sealants, and Caulks: Adhesives, sealants, and caulks used on the project shall meet the requirements of the following standards per CGBC Section 5.504.4.1:

   a. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in CBC Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products specified in subparagraph below.
   b. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

2. Sealants and sealant primers shall comply with maximum VOC limits listed in CGBC Table 5.504.4.2.

C. VOC Content: Sealants and sealant primers shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Architectural Sealants: 250 g/L.
2. Architectural Sealant Primers for Nonporous Substrates: 250 g/L.
3. Architectural Sealant Primers for Porous Substrates: 775 g/L.

D. Low-Emitting Materials: Sealants and sealant primers shall comply with the requirements of authorities having jurisdiction.

2.3 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

C. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

D. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

E. Colors of Exposed Joint Sealants: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

2.4 SILICONE JOINT SEALANTS

A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Dow Corning Corporation.
    b. GE Construction Sealants; Momentive Performance Materials Inc.
    c. May National Associates, Inc.; a subsidiary of Sika Corporation.
    d. Sika Corporation; Joint Sealants.
    e. Tremco Incorporated.

B. Silicone, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Dow Corning Corporation.
    b. GE Construction Sealants; Momentive Performance Materials Inc.
    c. May National Associates, Inc.; a subsidiary of Sika Corporation.
    d. Sika Corporation; Joint Sealants.
    e. Tremco Incorporated.

2.5 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.

B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Dow Corning Corporation.
    b. GE Construction Sealants; Momentive Performance Materials Inc.
    c. May National Associates, Inc.; a subsidiary of Sika Corporation.
    d. Sika Corporation; Joint Sealants.
    e. Tremco Incorporated.

C. Silicone, Nonstaining, S, NS, 100/50, T, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Dow Corning Corporation.
b. GE Construction Sealants; Momentive Performance Materials Inc.
c. May National Associates, Inc.; a subsidiary of Sika Corporation.
d. Sika Corporation; Joint Sealants.
e. Tremco Incorporated.

2.6 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Dow Corning Corporation.
b. GE Construction Sealants; Momentive Performance Materials Inc.
c. May National Associates, Inc.; a subsidiary of Sika Corporation.
d. Sika Corporation; Joint Sealants.
e. Tremco Incorporated.

2.7 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Bostik, Inc.
b. Pecora Corporation.

2.8 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Franklin International.

b. May National Associates, Inc.; a subsidiary of Sika Corporation.
c. Pecora Corporation.
d. Sherwin-Williams Company (The).
e. Tremco Incorporated.

2.9 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), Type O (open-cell material), Type B (bicellular material with a surface skin), or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.10 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include, but are not limited to, the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.
    d. Exterior insulation and finish systems.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include, but are not limited to, the following:

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
4. Provide flush joint profile at locations indicated on Drawings according to Figure 8B in ASTM C 1193.
5. Provide recessed joint configuration of recess depth and at locations indicated on Drawings according to Figure 8C in ASTM C 1193.

    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:

    a. Perform not less than 10 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
    b. Perform not less than one test for each 1000 feet (300 m) of joint length thereafter or one test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

    a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect tested joints and report on the following:

    a. Whether sealants filled joint cavities and are free of voids.
    b. Whether sealant dimensions and configurations comply with specified requirements.
    c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint

substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.

1. Joint locations include, but are not limited to, the following:

   a. Control and expansion joints in brick pavers.
   b. Isolation and contraction joints in cast-in-place concrete slabs.
   c. Joints between plant-precast architectural concrete paving units.
   d. Joints in stone paving units, including steps.
   e. Tile control and expansion joints.
   f. Joints between different materials listed above.
   g. Other joints as indicated on Drawings.

2. Joint Sealant:

   a. Silicone, S, NS, 100/50, T, NT unless otherwise indicated.
   b. Silicone, Nonstaining, S, NS, 100/50, T, NT where in contact with porous substances.

3. Joint-Sealant Color: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint locations include, but are not limited to, the following:

a. Construction joints in cast-in-place concrete.
b. Joints between plant-precast architectural concrete units.
c. Control and expansion joints in unit masonry.
d. Joints in dimension stone cladding.
e. Joints in glass unit masonry assemblies.
f. Joints in exterior insulation and finish systems.
g. Joints between metal panels.
h. Joints between different materials listed above.
i. Perimeter joints between materials listed above and frames of doors, windows, and louvers.
j. Control and expansion joints in ceilings, soffits, and other overhead surfaces.
k. Other joints as indicated on Drawings.

2. Joint Sealant:

a. Silicone, S, NS, 100/50, NT unless otherwise indicated.
b. Silicone, Nonstaining, S, NS, 100/50, NT where in contact with porous substances.

3. Joint-Sealant Color: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.

1. Joint locations include, but are not limited to, the following:

a. Isolation joints in cast-in-place concrete slabs.
b. Control and expansion joints in stone flooring.
c. Control and expansion joints in brick flooring.
d. Control and expansion joints in tile flooring.
e. Other joints as indicated on Drawings.

2. Joint Sealant:

a. Silicone, S, NS, 100/50, T, NT unless otherwise indicated.
b. Silicone, Nonstaining, S, NS, 100/50, T, NT where in contact with porous substances.

3. Joint-Sealant Color: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint locations include, but are not limited to, the following:

a. Control and expansion joints on exposed interior surfaces of exterior walls.
b. Tile control and expansion joints.
c. Vertical joints on exposed surfaces of unit masonry and concrete walls and partitions.

d. Joints on underside of plant-precast structural concrete beams and planks.
e. Other joints as indicated on Drawings.

2. Joint Sealant:

a. Silicone, S, NS, 100/50, NT unless otherwise indicated.
b. Silicone, Nonstaining, S, NS, 100/50, NT where in contact with porous substances.

3. Joint-Sealant Color: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.

1. Joint locations include, but are not limited to, the following:

a. Control joints on exposed interior surfaces of exterior walls.
b. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Acrylic latex.
3. Joint-Sealant Color: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

F. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint locations include, but are not limited to, the following:

a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Tile control and expansion joints where indicated.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
3. Joint-Sealant Color: White unless otherwise indicated.

G. Joint-Sealant Application: Concealed mastics.

1. Joint locations include, but are not limited to, the following:

a. Aluminum thresholds.
b. Sill plates.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Butyl-rubber based.
3. Joint-Sealant Color: Black unless otherwise indicated.

END OF SECTION 079200

SECTION 079219 - ACOUSTICAL JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes acoustical joint sealants.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for elastomeric, latex, and butyl-rubber-based joint sealants for nonacoustical applications.
2. Section 092900 "Gypsum Board" for sealing perimeter joints with acoustical sealant.
3. Section 095113 "Acoustical Panel Ceilings" for sealing edge moldings at perimeters with acoustical sealant.

1.3 ACTION SUBMITTALS

A. Product Data: For each acoustical joint sealant.

B. Samples for Verification: For each kind and color of acoustical joint sealant required, provide Samples with joint sealants in 1/2 inch (13 mm) wide joints formed between two 6 inch (150 mm) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Acoustical-Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each kind of acoustical joint sealant, for tests performed by a qualified testing agency.

B. Sample Warranties: For special warranties.

1.5 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace acoustical joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish acoustical joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain acoustical joint sealants from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Provide acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies according to ASTM E 90.

2.3 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Finish Material Pollutant Control: Finish materials shall comply with CGBC Sections 5.504.4.1 through 5.504.4.6 per CGBC Section 5.504.4.

1. Adhesives, Sealants, and Caulks: Adhesives, sealants, and caulks used on the project shall meet the requirements of the following standards per CGBC Section 5.504.4.1:

a. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in CBC Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products specified in subparagraph below.
b. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

2. Sealants and sealant primers shall comply with maximum VOC limits listed in CGBC Table 5.504.4.2.

C. VOC Content: Sealants and sealant primers shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Architectural Sealants: 250 g/L.
2. Architectural Sealant Primers for Nonporous Substrates: 250 g/L.
3. Architectural Sealant Primers for Porous Substrates: 775 g/L.

D. Low-Emitting Materials: Sealants and sealant primers shall comply with the requirements of authorities having jurisdiction.

2.4 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C 834.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:

a. Accumetric LLC; BOSS 826 Acoustical Sound Sealant.
b. Franklin International; Titebond GREENchoice Professional Acoustical Smoke & Sound Sealant.
c. GE Construction Sealants; Momentive Performance Materials Inc.; RCS20 Acoustical.
d. Grabber Construction Products; Acoustical Sealant GSC.
e. Hilti, Inc.; CP 506 Smoke and Acoustical Sealant.
f. OSI Sealants; Henkel Corporation; OSI Pro-Series SC-175 Acoustical Sound Sealant.
g. Serious Energy Inc.; Quiet Seal Pro.
h. Tremco Incorporated; Tremco Acoustical Sealant.
i. United States Gypsum Company; SHEETROCK Acoustical Sealant.

2. Colors of Exposed Acoustical Joint Sealants: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

2.5 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by acoustical-joint-sealant manufacturer where required for adhesion of sealant to joint substrates.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive acoustical joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where recommended by acoustical-joint-sealant manufacturer. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.

B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C 919, ASTM C 1193, and manufacturer's written recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.

C. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of acoustical joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect acoustical joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration

or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated acoustical joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079219

This page intentionally left blank.

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Interior standard steel doors and frames.
2. Exterior standard steel doors and frames.

B. Related Requirements:

1. Section 081416 "Flush Wood Doors" for wood doors installed in hollow-metal frames.
2. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.
3. Section 088000 "Glazing" for glass view panels in hollow-metal doors.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.4 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
7. Details of anchorages, joints, field splices, and connections.
8. Details of accessories.
9. Details of moldings, removable stops, and glazing.

C. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For door inspector.

1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
2. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
3. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.

B. Product Test Reports: For each type of fire-rated hollow-metal door and frame assembly, fire-rated borrowed-lite assembly, and thermally rated door assemblies for tests performed by a qualified testing agency indicating compliance with performance requirements.

C. Oversize Construction Certification: For assemblies required to be fire-rated and exceeding limitations of labeled assemblies.

1.8 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.9 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies shall meet the qualifications set forth in NFPA 80, section 5.2.3.1 and the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

B. Egress Door Inspector Qualifications: Inspector for field quality control inspections of egress door assemblies shall meet the qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on not less than 4 inch (102 mm) high wood blocking. Provide not less than 1/4 inch (6 mm) space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Airtec Corporation.
2. Apex Industries, Inc.
3. Baron Metal Industries Inc.; an Assa Abloy Group company.
4. Ceco Door; ASSA ABLOY.
5. Concept Frames, Inc.
6. Curries Company; ASSA ABLOY.
7. Custom Metal Products.
8. Daybar Industries, Ltd.
9. DCI Hollow Metal.
10. DE LA FONTAINE.
11. Deansteel Manufacturing Company, Inc.
12. Deronde Products.
13. DKS Steel Door & Frame Systems, Inc.
14. Fleming Door Products Ltd.; Assa Abloy Group Company.
15. Gensteel Doors, Inc.
16. HMF Express, LLC.
17. Hollow Metal Inc.
18. Hollow Metal Xpress.
19. JR Metal Frames Manufacturing, Inc.
20. Karpen Steel Custom Doors & Frames.
21. L.I.F. Industries, Inc.
22. LaForce, Inc.
23. Megamet Industries, Inc.
24. Mesker Door Inc.
25. Metropolitan Door Industries Corp.
26. Michbi Doors Inc.

27. MPI Group, LLC (The).
28. National Custom Hollow Metal Doors & Frames.
29. North American Door Corp.
30. Philipp Manufacturing Co (The).
31. Pioneer Industries.
32. Premier Products, Inc.
33. Republic Doors and Frames.
34. Rocky Mountain Metals, Inc.
35. Security Metal Products; a brand of ASSA ABLOY.
36. Shanahan's Manufacturing Limited.
37. Steelcraft; an Allegion brand.
38. Steward Steel Door & Frame Division.
39. Stiles Custom Metal, Inc.
40. Trillium Steel Doors Limited.
41. West Central Manufacturing, Inc.

B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 ACCESSIBILITY REQUIREMENTS

A. Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

B. Doors, Doorways, and Gates:

1. General: Doors, doorways, and gates that are part of an accessible route shall comply with CBC Section 11B-404 per CBC Section 11B-404.1.

    a. Exceptions:

        1) Doors, doorways, and gates designed to be operated only by security personnel shall not be required to comply with CBC Sections 11B-404.2.7, 11B-404.2.8, 11B-4042.9, 11B-404.3.2, and 11B-404.3.4 through 11B-404.3.7. A sign visible from the approach side complying with CBC Section 11B-703.5 shall be posted stating "ENTRY RESTRICTED AND CONTROLLED BY SECURITY PERSONNEL."
        2) At detention and correctional facilities, doors, doorways, and gates designed to be operated only by security personnel shall not be required to comply with CBC Sections 11B-404.2.7, 11B-404.2.8, 11B-4042.9, 11B-404.3.2, and 11B-404.3.4 through 11B-404.3.7.

2. Manual Doors, Doorways, and Manual Gates: Manual doors and doorways and manual gates intended for user passage shall comply with CBC Section 11B-404.2 per CBC Section 11B-404.2.

    a. Revolving Doors, Gates, and Turnstiles: Revolving doors, revolving gates, and turnstiles shall not be part of an accessible route per CBC Section 11B-404.2.1.
    b. Double-Leaf Doors and Gates: At least one of the active leaves of doorways with two leaves shall comply with CBC Sections 11B-404.2.3 and 11B-404.2.4 per CBC Section 11B-404.2.2.
    c. Clear Width: Openings shall provide a clear width of 32 inches (813 mm) minimum. Clear openings of doorways with swinging doors shall be measured between the face of the door and the stop, with the door open 90 degrees. Openings more than 24 inches (610 mm) deep shall provide a clear opening of 36 inches (914 mm) minimum. There shall be no projections into the required clear opening width lower than 34 inches (864 mm) above the finish floor or ground.

Projections into the clear opening width between 34 inches (864 mm) and 80 inches (2032 mm) above the finish floor or ground shall not exceed 4 inches (102 mm) per CBC Section 11B-404.2.3 and CBC Figure 11B-404.2.3.

1) Exceptions:

a) In alterations, a projection of 5/8 inch (15.9 mm) maximum into the required clear width shall be permitted for the latch side stop.
b) Door closers and door stops shall be permitted to be 78 inches (1981 mm) minimum above the finish floor or ground.

d. Maneuvering Clearances: Minimum maneuvering clearances at doors and gates shall comply with CBC Section 11B-404.2.4. Maneuvering clearances shall extend the full width of the doorway and the required latch side or hinge side clearance per CBC Section 11B-404.2.4.

1) Swinging Doors and Gates: Swinging doors and gates shall have maneuvering clearances complying with CBC Table 11B-404.2.4.1 per CBC Section 11B-404.2.4.1.
2) Doorways Without Doors or Gates, Sliding Doors, and Folding Doors: Doorways less than 36 inches (914 mm) wide without doors or gates, sliding doors, or folding doors shall have maneuvering clearances complying with CBC Table 11B-404.2.4.2 per CBC Section 11B-404.2.4.2.
3) Recessed Doors and Gates: Maneuvering clearances for forward approach shall be provided when any obstruction within 18 inches (457 mm) of the latch side at an interior doorway, or within 24 inches (610 mm) of the latch side of an exterior doorway, projects more than 8 inches (203 mm) beyond the face of the door, measured perpendicular to the face of the door or gate per CBC Section 11B-404.2.4.3.
4) Floor or Ground Surface: Floor or ground surface within required maneuvering clearances shall comply with CBC Section 11B-302. Changes in level are not permitted per CBC Section 11B-404.2.4.4.

a) Exception:

1. Slopes not steeper than 1:48 shall be permitted.
2. Changes in level at thresholds complying with CBC Section 11B-404.2.5 shall be permitted.

e. Thresholds: Thresholds, if provided at doorways, shall be 1/2 inch (12.7 mm) high maximum. Raised thresholds and changes in level at doorways shall comply with CBC Sections 11B-302 and 11B-303 per CBC Section 11B-404.2.5.

f. Doors in a Series and Gates in a Series: The distance between two hinged or pivoted doors in series and gates in series shall be 48 inches (1219 mm) minimum plus the width of the doors or gates swinging into the space per CBC Section 11B-404.2.6.

g. Door and Gate Hardware: Handles, pulls, latches, locks, and other operable parts on doors and gates shall comply with CBC Section 11B-309.4. Operable parts of such hardware shall be 34 inches (864 mm) minimum and 44 inches (1118 mm) maximum above the finish floor or ground. Where sliding doors are in the fully open position, operating hardware shall be exposed and usable from both sides per CBC Section 11B-404.2.7.

1) Exceptions:

a) Existing locks shall be permitted in any location at existing glazed doors without stiles, existing overhead rolling doors or grilles, and similar existing doors or

grilles that are designed with locks that are activated only at the top or bottom rail.

b) Access gates in barrier walls and fences protecting pools, spas, and hot tubs shall be permitted to have operable parts of the release latch on self-latching devices at 54 inches (1372 mm) maximum above the finish floor or ground provided the self-latching devices are not also self-locking devices and operated by means of a key, electronic opener, or integral combination lock.

2) Operation: Operable parts shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate operable parts shall be 5 pounds (22.2 N) maximum per CBC Section 11B-309.4.

h. Closing Speed: Door and gate closing speed shall comply with CBC Section 11B-404.2.8 per CBC Section 11B-404.2.8.

1) Door Closers and Gate Closers: Door closers and gate closers shall be adjusted so that from an open position of 90 degrees, the time required to move the door to a position of 12 degrees from the latch is 5 seconds minimum per CBC Section 11B-404.2.8.1.
2) Spring Hinges: Door and gate spring hinges shall be adjusted so that from the open position of 70 degrees, the door or gate shall move to the closed position in 1.5 seconds minimum per CBC Section 11B-404.2.8.2.

i. Door and Gate Opening Force: The force for pushing or pulling open a door or gate shall be as follows per CBC Section 11B-404.2.9:

1) Interior Hinged Doors and Gates: 5 pounds (22.2 N) maximum.
2) Sliding or Folding Doors: 5 pounds (22.2 N) maximum.
3) Required Fire Doors: The minimum opening force allowable by the appropriate administrative authority, not to exceed 15 pounds (66.7 N).
4) Exterior Hinged Doors: 5 pounds (22.2 N) maximum.
5) These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door or gate in a closed position.
6) Operation: Operable parts shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate operable parts shall be 5 pounds (22.2 N) maximum per CBC Section 11B-309.4.
7) Door Opening Force: The force for pushing or pulling open interior swinging egress doors, other than fire doors, shall not exceed 5 pounds (22.2 N). These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position. For other swinging doors, as well as sliding and folding doors, the door latch shall release when subjected to a 15 pound (67 N) force. The door shall be set in motion when subjected to a 30 pound (133 N) force. The door shall swing to a full-open position when subjected to a 15 pound (67 N) force per CBC Section 1010.1.3.

a) Location of Applied Forces: Forces shall be applied to the latch side of the door per CBC Section 1010.1.3.1.

j. Door and Gate Surfaces: Swinging door and gate surfaces within 10 inches (254 mm) of the finish floor or ground measured vertically shall have a smooth surface on the push side extending the full width of the door or gate. Parts creating horizontal or vertical joints in these surfaces shall be within 1/16 inch (1.6 mm) of the same plane as the other and be free of sharp or abrasive edges. Cavities created by added kick plates shall be capped per CBC Section 11B-404.2.10.

1) Exceptions:

a) Sliding doors shall not be required to comply with CBC Section 11B-404.2.10.
b) Tempered glass doors without stiles and having a bottom rail or shoe with the top leading edge tapered at 60 degrees minimum from the horizontal shall not be required to meet the 10 inch (254 mm) bottom smooth surface height requirement.
c) Doors and gates that do not extend to within 10 inches (254 mm) of the finish floor or ground shall not be required to comply with CBC Section 11B-404.2.10.

k. Vision Lights (Lites): Doors, gates, and side lights (lites) adjacent to doors or gates, containing one or more glazing panels that permit viewing through the panels shall have the bottom of at least one glazed panel located 43 inches (1092 mm) maximum above the finish floor per CBC Section 11B-404.2.11.

1) Exception: Glazing panels with the lowest part more than 66 inches (1676 mm) from the finish floor or ground shall not be required to comply with CBC Section 11B-404.2.11.

2.3 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated on Drawings, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
2. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
3. Temperature-Rise Limit: Where indicated on Drawings and at vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.

B. Fire-Rated, Borrowed-Lite Assemblies: Assemblies complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

C. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.50 deg Btu/F x h x sq. ft. (2.84 W/K x sq. m) when tested according to ASTM C518.

2.4 REGULATORY REQUIREMENTS

A. All insulation provided for use on this project shall be identified as required by Section 12-13-1557 of the California Referenced Standards Code (Part 12, Title 24, C.C.R.); Chapter 12-13 "Standards For Insulating Material", (See Part 6, Title 24, C.C.R.); Department Of Consumer Affairs, Bureau of Home Furnishings and Thermal Insulation; Article 3: "Standards for Insulating Material".

2.5 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Recycled Content of Steel Products: Recycled content not less than 20 percent.

C. Thermal Insulation, Tier 1: Per CGBC Section A5.504.4.8, comply with the following standards:

1. Chapters 12-13 (Standards for Insulating Material) in Title 24, Part 12, the California Referenced Standards Code.
2. The VOC-emission limits defined in 2009 CHPS criteria and listed in its High Performance Products Database.
3. California Department of Public Health 2010 Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1, February 2010 (also known as Specification 01350).

D. Thermal Insulation, Tier 2: Thermal insulation, No-added Formaldehyde. Install thermal insulation which complies with Tier 1 plus does not contain any added formaldehyde per CGBC Section A5.504.4.8.1.

E. Provide mineral-wool blanket insulation as follows:

1. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05 ppm formaldehyde.
2. Recycled Content: Recycled content not less than 20 percent.

2.6 INTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches (44.5 mm).
c. Face: Metallic-coated steel sheet, not less than 0.042 inch (1.06 mm) thick (18 gage nominal), with not less than A40 (ZF120) coating.
d. Edge Construction: Model 2, Seamless.
e. Edge Bevel: Bevel lock and hinge edges 1/8 inch in 2 inches (3.2 mm in 51 mm).
f. Core: Manufacturer's standard polystyrene, polyurethane, or polyisocyanurate.
g. Fire-Rated Core: Manufacturer's standard laminated mineral board core for fire-rated and temperature-rise-rated doors.

2. Frames:

a. Materials: Metallic-coated steel sheet, not less than 0.053 inch (1.34 mm) thick (16 gage nominal), with not less than A40 (ZF120) coating.
b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
c. Construction: Full profile welded.

3. Exposed Finish: Prime.

2.7 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches (44.5 mm).
c. Face: Metallic-coated steel sheet, not less than 0.053 inch (1.34 mm) thick (16 gage nominal), with not less than A60 (ZF180) coating.
d. Edge Construction: Model 2, Seamless.
e. Edge Bevel: Bevel lock and hinge edges 1/8 inch in 2 inches (3.2 mm in 51 mm).
f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
g. Bottom Edges: Close bottom edges of doors with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
h. Core: Manufacturer's standard polystyrene, polyurethane, or polyisocyanurate.
i. Fire-Rated Core: Manufacturer's standard laminated mineral board core for fire-rated doors.

2. Frames:

a. Materials: Metallic-coated steel sheet, not less than 0.053 inch (1.34 mm) thick (16 gage nominal), with not less than A60 (ZF180) coating.
b. Construction: Full profile welded.

3. Exposed Finish: Prime.

2.8 BORROWED LITES

A. Materials: metallic-coated steel sheet, not less than 0.053 inch (1.34 mm) thick (16 gage nominal), with not less than A40 (ZF120) coating.

B. Construction: Full profile welded.

C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.

D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.9 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Not less than three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches (610 mm) of frame height above 7 feet (2.1 m).

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized according to ASTM A153/A153M, Class B.

2.10 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.

E. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

F. Glazing: Comply with requirements in Section 088000 "Glazing."

2.11 FABRICATION

A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating and where indicated. Extend not less than 3/4 inch (19 mm) beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to ANSI/SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

D. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with mitered hairline joints.

1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
2. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
3. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
4. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

2.12 STEEL FINISHES

A. Prime Finish for Interior Doors and Frames: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

B. Prime Finish for Exterior Doors and Frames: Zinc-rich primer.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Tnemec Company, Inc.; Series 94-H2O Hydro-Zinc, or comparable product by another manufacturer.

    a. Apply at a dry film thickness of not less than 2.5 to 3.5 mils (0.0635 to 0.0889 mm).

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

    a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
    b. Install frames with removable stops located on secure side of opening.

2. Fire-Rated Openings: Install frames according to NFPA 80.
3. Floor Anchors: Secure with postinstalled expansion anchors.
4. Solidly pack mineral-fiber insulation inside frames.
5. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.
2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 STEEL AND IRON FINISHES

A. Preparation for Shop Priming Exterior Doors and Frames: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

1. SSPC-SP 1, "Solvent Cleaning" to remove all soluble contamination. Thoroughly roughen the entire surface to be coated using compressed air nozzle brush off blast cleaning with a fine abrasive to achieve a uniform anchor profile of 1.0 to 2.0 mils (0.0254 to 0.0508 mm). Reference ASTM D 6386, Section 5.4.1.

B. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

C. Preparation for Field Priming: Clean field welds, bolted connections, and areas where shop primer is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

1. SSPC-SP 11, "Power Tool Cleaning to Bare Metal" all welds and damaged zinc-rich primer.

3.4 FIELD QUALITY CONTROL

A. Inspection Agency: Owner will engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:

1. Fire-Rated Door Inspections: Inspect each fire-rated door according to NFPA 80, Section 5.2.
2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements according to NFPA 101, Section 7.2.1.15.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door and egress door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.5 ADJUSTING

A. Adjust operating door hardware to function smoothly as recommended by manufacturer.

1. For doors accessible to people with disabilities, adjust closers so that from an open position of 90 degrees, the time required to move the door to a position 12 degrees from the latch is not less than 5 seconds.
2. For doors accessible to people with disabilities, adjust spring hinges so that from an open position of 70 degrees, the time required to move the door to the closed position is not less than 1.5 seconds.

B. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work.

C. Operation: Rehang or replace doors that do not swing or operate freely.

3.6 REPAIR

A. Prime-Coat Touchup for Interior Doors and Frames: Immediately after installation, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

B. Touchup Painting for Exterior Doors and Frames:

1. Immediately after installation, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

a. Apply by brush or spray to provide a dry film thickness of not less than 2.5 mils (0.0635 mm).

C. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Seven-ply flush wood veneer-faced doors for transparent finish.
2. Fire-rated wood door frames.
3. Factory finishing flush wood doors.
4. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Requirements:

1. Section 087100 "Door Hardware" for door hardware for flush wood doors.
2. Section 088000 "Glazing" for glass view panels in flush wood doors.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door trim for openings.
5. Factory-machining criteria.
6. Factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Product Schedule:

a. For flush wood doors, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings.
b. Coordinate with final door hardware schedule.

c. Indicate door and frame location, type, size, fire protection rating, and swing.

2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Dimensions and locations of blocking for hardware attachment.
4. Dimensions and locations of mortises and holes for hardware.
5. Dimensions and locations of openings for light frames and louvers.
6. Clearances and undercuts.
7. Requirements for veneer matching.
8. Doors to be factory finished and application requirements.
9. Fire-protection ratings for fire-rated doors.
10. Apply WI Certified Compliance Program label to Shop Drawings.

C. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
2. Corner sections of doors, approximately 8 by 10 inches (200 by 250 mm), with door faces and edges representing actual materials to be used.

a. Provide Samples for each species of veneer and solid lumber required.
b. Finish veneer-faced door Samples with same materials proposed for factory-finished doors.

3. Louver blade and frame sections, 6 inches (150 mm) long, for each material and finish specified.
4. Frames for light openings, 6 inches (150 mm) long, for each material, type, and finish required.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For door inspector.

1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
2. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
3. Submit copy of DHI's Fire and Egress Door Assembly Inspector (FDAI) certificate.

B. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Special warranties.

B. Quality Standard Compliance Certificates: WI Certified Compliance Program certificates.

C. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.7 QUALITY ASSURANCE

A. Manufacturer's Certification: Licensed participant in WI's Certified Compliance Program.

B. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies shall comply with qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:

1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

C. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies shall comply with qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:

1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons, and wrap bundles of doors in plastic sheeting.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Delamination of veneer.
b. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42 by 84 inch (1067 by 2134 mm) section.
c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3 inch (0.25 mm in a 76.2-mm) span.

2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 ACCESSIBILITY REQUIREMENTS

A. Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

B. Doors, Doorways, and Gates:

1. General: Doors, doorways, and gates that are part of an accessible route shall comply with CBC Section 11B-404 per CBC Section 11B-404.1.

a. Exceptions:

1) Doors, doorways, and gates designed to be operated only by security personnel shall not be required to comply with CBC Sections 11B-404.2.7, 11B-404.2.8, 11B-4042.9, 11B-404.3.2, and 11B-404.3.4 through 11B-404.3.7. A sign visible from the approach side complying with CBC Section 11B-703.5 shall be posted stating "ENTRY RESTRICTED AND CONTROLLED BY SECURITY PERSONNEL."
2) At detention and correctional facilities, doors, doorways, and gates designed to be operated only by security personnel shall not be required to comply with CBC Sections 11B-404.2.7, 11B-404.2.8, 11B-4042.9, 11B-404.3.2, and 11B-404.3.4 through 11B-404.3.7.

2. Manual Doors, Doorways, and Manual Gates: Manual doors and doorways and manual gates intended for user passage shall comply with CBC Section 11B-404.2 per CBC Section 11B-404.2.

a. Revolving Doors, Gates, and Turnstiles: Revolving doors, revolving gates, and turnstiles shall not be part of an accessible route per CBC Section 11B-404.2.1.
b. Double-Leaf Doors and Gates: At least one of the active leaves of doorways with two leaves shall comply with CBC Sections 11B-404.2.3 and 11B-404.2.4 per CBC Section 11B-404.2.2.
c. Clear Width: Openings shall provide a clear width of 32 inches (813 mm) minimum. Clear openings of doorways with swinging doors shall be measured between the face of the door and the stop, with the door open 90 degrees. Openings more than 24 inches (610 mm) deep shall provide a clear opening of 36 inches (914 mm) minimum. There shall be no projections into the required clear opening width lower than 34 inches (864 mm) above the finish floor or ground. Projections into the clear opening width between 34 inches (864 mm) and 80 inches (2032 mm) above the finish floor or ground shall not exceed 4 inches (102 mm) per CBC Section 11B-404.2.3 and CBC Figure 11B-404.2.3.

1) Exceptions:

a) In alterations, a projection of 5/8 inch (15.9 mm) maximum into the required clear width shall be permitted for the latch side stop.
b) Door closers and door stops shall be permitted to be 78 inches (1981 mm) minimum above the finish floor or ground.

d. Maneuvering Clearances: Minimum maneuvering clearances at doors and gates shall comply with CBC Section 11B-404.2.4. Maneuvering clearances shall extend the full width of the doorway and the required latch side or hinge side clearance per CBC Section 11B-404.2.4.

1) Swinging Doors and Gates: Swinging doors and gates shall have maneuvering clearances complying with CBC Table 11B-404.2.4.1 per CBC Section 11B-404.2.4.1.
2) Doorways Without Doors or Gates, Sliding Doors, and Folding Doors: Doorways less than 36 inches (914 mm) wide without doors or gates, sliding doors, or folding doors

shall have maneuvering clearances complying with CBC Table 11B-404.2.4.2 per CBC Section 11B-404.2.4.2.

3) Recessed Doors and Gates: Maneuvering clearances for forward approach shall be provided when any obstruction within 18 inches (457 mm) of the latch side at an interior doorway, or within 24 inches (610 mm) of the latch side of an exterior doorway, projects more than 8 inches (203 mm) beyond the face of the door, measured perpendicular to the face of the door or gate per CBC Section 11B-404.2.4.3.

4) Floor or Ground Surface: Floor or ground surface within required maneuvering clearances shall comply with CBC Section 11B-302. Changes in level are not permitted per CBC Section 11B-404.2.4.4.

a) Exception:

1. Slopes not steeper than 1:48 shall be permitted.
2. Changes in level at thresholds complying with CBC Section 11B-404.2.5 shall be permitted.

e. Thresholds: Thresholds, if provided at doorways, shall be 1/2 inch (12.7 mm) high maximum. Raised thresholds and changes in level at doorways shall comply with CBC Sections 11B-302 and 11B-303 per CBC Section 11B-404.2.5.

f. Doors in a Series and Gates in a Series: The distance between two hinged or pivoted doors in series and gates in series shall be 48 inches (1219 mm) minimum plus the width of the doors or gates swinging into the space per CBC Section 11B-404.2.6.

g. Door and Gate Hardware: Handles, pulls, latches, locks, and other operable parts on doors and gates shall comply with CBC Section 11B-309.4. Operable parts of such hardware shall be 34 inches (864 mm) minimum and 44 inches (1118 mm) maximum above the finish floor or ground. Where sliding doors are in the fully open position, operating hardware shall be exposed and usable from both sides per CBC Section 11B-404.2.7.

1) Exceptions:

a) Existing locks shall be permitted in any location at existing glazed doors without stiles, existing overhead rolling doors or grilles, and similar existing doors or grilles that are designed with locks that are activated only at the top or bottom rail.

b) Access gates in barrier walls and fences protecting pools, spas, and hot tubs shall be permitted to have operable parts of the release latch on self-latching devices at 54 inches (1372 mm) maximum above the finish floor or ground provided the self-latching devices are not also self-locking devices and operated by means of a key, electronic opener, or integral combination lock.

2) Operation: Operable parts shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate operable parts shall be 5 pounds (22.2 N) maximum per CBC Section 11B-309.4.

h. Closing Speed: Door and gate closing speed shall comply with CBC Section 11B-404.2.8 per CBC Section 11B-404.2.8.

1) Door Closers and Gate Closers: Door closers and gate closers shall be adjusted so that from an open position of 90 degrees, the time required to move the door to a position of 12 degrees from the latch is 5 seconds minimum per CBC Section 11B-404.2.8.1.

2) Spring Hinges: Door and gate spring hinges shall be adjusted so that from the open position of 70 degrees, the door or gate shall move to the closed position in 1.5 seconds minimum per CBC Section 11B-404.2.8.2.

i. Door and Gate Opening Force: The force for pushing or pulling open a door or gate shall be as follows per CBC Section 11B-404.2.9:

1) Interior Hinged Doors and Gates: 5 pounds (22.2 N) maximum.
2) Sliding or Folding Doors: 5 pounds (22.2 N) maximum.
3) Required Fire Doors: The minimum opening force allowable by the appropriate administrative authority, not to exceed 15 pounds (66.7 N).
4) Exterior Hinged Doors: 5 pounds (22.2 N) maximum.
5) These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door or gate in a closed position.
6) Operation: Operable parts shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate operable parts shall be 5 pounds (22.2 N) maximum per CBC Section 11B-309.4.
7) Door Opening Force: The force for pushing or pulling open interior swinging egress doors, other than fire doors, shall not exceed 5 pounds (22.2 N). These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position. For other swinging doors, as well as sliding and folding doors, the door latch shall release when subjected to a 15 pound (67 N) force. The door shall be set in motion when subjected to a 30 pound (133 N) force. The door shall swing to a full-open position when subjected to a 15 pound (67 N) force per CBC Section 1010.1.3.

a) Location of Applied Forces: Forces shall be applied to the latch side of the door per CBC Section 1010.1.3.1.

j. Door and Gate Surfaces: Swinging door and gate surfaces within 10 inches (254 mm) of the finish floor or ground measured vertically shall have a smooth surface on the push side extending the full width of the door or gate. Parts creating horizontal or vertical joints in these surfaces shall be within 1/16 inch (1.6 mm) of the same plane as the other and be free of sharp or abrasive edges. Cavities created by added kick plates shall be capped per CBC Section 11B-404.2.10.

1) Exceptions:

a) Sliding doors shall not be required to comply with CBC Section 11B-404.2.10.
b) Tempered glass doors without stiles and having a bottom rail or shoe with the top leading edge tapered at 60 degrees minimum from the horizontal shall not be required to meet the 10 inch (254 mm) bottom smooth surface height requirement.
c) Doors and gates that do not extend to within 10 inches (254 mm) of the finish floor or ground shall not be required to comply with CBC Section 11B-404.2.10.

k. Vision Lights (Lites): Doors, gates, and side lights (lites) adjacent to doors or gates, containing one or more glazing panels that permit viewing through the panels shall have the bottom of at least one glazed panel located 43 inches (1092 mm) maximum above the finish floor per CBC Section 11B-404.2.11.

1) Exception: Glazing panels with the lowest part more than 66 inches (1676 mm) from the finish floor or ground shall not be required to comply with CBC Section 11B-404.2.11.

2.3 PERFORMANCE REQUIREMENTS

A. Fire-Rated Wood Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings and temperature-rise limits indicated on Drawings, based on testing at positive pressure in accordance with UL 10C or NFPA 252.

1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
2. Temperature-Rise Limit: Where indicated on Drawings and at vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.

B. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

2.4 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Regional Materials: Flush wood doors shall be manufactured within 500 miles (800 km) of Project site.

C. Finish Material Pollutant Control: Finish materials shall comply with CGBC Sections 5.504.4.1 through 5.504.4.6 per CGBC Section 5.504.4.

1. Adhesives, Sealants, and Caulks: Adhesives, sealants, and caulks used on the project shall meet the requirements of the following standards per CGBC Section 5.504.4.1:

   a. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in CBC Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products specified in subparagraph below.
   b. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

2. Adhesives shall comply with maximum VOC limits listed in CGBC Table 5.504.4.1.
3. Composite Wood Products: Hardwood plywood, particleboard, and medium density fiberboard composite wood products used on the interior or exterior of the building shall meet the requirements for formaldehyde as specified in ARB's Air Toxics Control Measure (ATCM) for Composite Wood (17 CCR 93120 et seq.). Those materials not exempted under the ATCM must meet the specified emission limits, as shown in CGBC Table 5.504.4.5 per CGBC Section 5.504.4.5.

D. Adhesives: Do not use adhesives that contain urea formaldehyde.

E. Low-Emitting Materials: Composite wood products shall be made without urea formaldehyde.

F. Low-Emitting Materials: Adhesives shall comply with the requirements of authorities having jurisdiction.

G. Low-Emitting Materials: Paints and coatings shall comply with the requirements of authorities having jurisdiction.

2.5 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with the WI's/AWMAC's "North American Architectural Woodwork Standards 3.0" and ANSI/WDMA I.S. 1A.

1. Provide labels and certificates from WI certification program indicating that doors comply with requirements of grades specified.
2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

2.6 SEVEN-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Doors:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. ABS-American Building Supply, Inc.
    b. General Veneer Manufacturing Co.
    c. Haley Brothers, Inc.
    d. Lambton Doors.
    e. Oregon Door.
    f. Vancouver Door Company.

2. Performance Grade: ANSI/WDMA I.S. 1A Extra Heavy Duty unless otherwise indicated.

3. North American Architectural Woodwork Standards 3.0 Grade: Premium, with Grade AA faces.
4. Faces: Two-ply wood panel with wood veneer not less than 1/50 inch (0.508 mm) thick.

    a. Species: Select white maple.
    b. Cut: Plain sliced (flat sliced)/plain sawn.
    c. Match between Veneer Leaves: Book match.
    d. Assembly of Veneer Leaves on Door Faces: Center-balance match.
    e. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
    f. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.

5. Exposed Vertical and Top Edges: Same species as faces or a compatible species - North American Architectural Woodwork Standards 3.0 edge Type A.

    a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.

b. Fire-Rated Pairs of Doors: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
c. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

1) Screw-Holding Capability: 550 lbf (2440 N) in accordance with WDMA T.M. 10.

6. Core for Non-Fire-Rated Doors: WDMA I.S. 10 structural composite lumber.

a. Screw Withdrawal, Door Face: 550 lbf (2440 N).
b. Screw Withdrawal, Vertical Door Edge: 550 lbf (2440 N).
c. Blocking: Provide wood blocking in structural composite lumber-core doors as needed to eliminate through-bolting hardware and as follows:

1) 5 inch (125 mm) top-rail blocking, in doors indicated to have closers.
2) 5 inch (125 mm) bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.

7. Core for Fire-Rated Doors: Structural composite lumber or mineral core as required to achieve fire-protection rating indicated on Drawings.

a. Mineral-Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
b. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as needed to eliminate through-bolting hardware and as follows:

1) 5 inch (125 mm) top-rail blocking.
2) 5 inch (125 mm) bottom-rail blocking, in doors indicated to have protection plates.
3) 5 inch (125 mm) midrail blocking, in doors indicated to have armor plates.
4) 5 inch (125 mm) midrail blocking, in doors indicated to have exit devices.

8. Construction: Seven plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.
9. Thickness: 1-3/4 inches (44.5 mm) unless otherwise indicated.

2.7 LIGHT FRAMES AND LOUVERS

A. Metal Frames for Light Openings in Non-Fire-Rated Doors: Manufacturer's standard frame formed of metallic-coated cold-rolled steel sheet, not less than 0.0478 inch (1.21 mm) thick (18 gage nominal), with not less than A40 (ZF120) coating; with baked-enamel or powder-coated finish.

B. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of metallic-coated cold-rolled steel sheet, not less than 0.0478 inch (1.21 mm) thick (18 gage nominal), with not less than A40 (ZF120) coating; with baked-enamel or powder-coated finish; and approved for use in doors of fire-protection rating indicated on Drawings.

2.8 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.

1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
2. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.

1. Locate hardware to comply with DHI-WDHS-3.
2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.

C. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."

2.9 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.

1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
2. Finish faces, all four edges, edges of cutouts, and mortises.
3. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:

1. North American Architectural Woodwork Standards 3.0 Grade: Premium.
2. Finish: North American Architectural Woodwork Standards 3.0 System-10, UV Curable, Water Based.
3. Staining: Match Architect's sample.
4. Effect: Open-grain finish.
5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.

2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware."

B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

1. Install fire-rated doors and frames in accordance with NFPA 80.
2. Install smoke- and draft-control doors in accordance with NFPA 105.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Owner will engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:

1. Provide inspection of installed Work through WI's Certified Compliance Program, certifying that wood doors and frames, including installation, comply with requirements of AWI/AWMCA/WI's "Architectural Woodwork Standards" for the specified grade.
2. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
3. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door and egress door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 ADJUSTING

A. Adjust operating door hardware to function smoothly as recommended by manufacturer.

1. For doors accessible to people with disabilities, adjust closers so that from an open position of 90 degrees, the time required to move the door to a position 12 degrees from the latch is not less than 5 seconds.

2. For doors accessible to people with disabilities, adjust spring hinges so that from an open position of 70 degrees, the time required to move the door to the closed position is not less than 1.5 seconds.

B. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including flush wood doors that are warped, bowed, or otherwise unacceptable.

C. Operation: Rehang or replace doors that do not swing or operate freely.

3.5 REPAIR

A. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes access doors and frames for walls and ceilings.

B. Related Requirements:

1. Section 233300 "Air Duct Accessories" for heating and air-conditioning duct access doors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples for Verification: For each type of access door and frame and for each finish specified, complete assembly not less than 6 by 6 inches (150 by 150 mm) in size.

C. Product Schedule: For access doors and frames. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing and inspecting agency.

1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, section 5.2.3.1.
2. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.

1.5 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

1.6 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies shall meet the qualifications set forth in NFPA 80, section 5.2.3.1 and the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection and temperature-rise limit ratings indicated, according to NFPA 252 or UL 10B.

2.3 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Recycled Content of Steel Products: Recycled content not less than 20 percent.

C. Recycled Content of Stainless-Steel Products: Recycled content not less than 20 percent.

D. Low-Emitting Materials: Paints and coatings shall comply with the requirements of authorities having jurisdiction.

2.4 INTERIOR ACCESS DOORS AND FRAMES

A. Flush Access Doors with Exposed Flanges:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Acudor Products, Inc.
b. Babcock-Davis.
c. Cendrex Inc.
d. Elmdor/Stoneman Manufacturing Company; a division of Acorn Engineering Company.
e. JL Industries, Inc.; a division of the Activar Construction Products Group.
f. Karp Associates, Inc.
g. Lane-Aire Manufacturing Corp.
h. Larsens Manufacturing Company.
i. Maxam Metal Products Limited.
j. Metropolitan Door Industries Corp.

k. MIFAB, Inc.
l. Milcor; Commercial Products Group of Hart & Cooley, Inc.
m. Nystrom, Inc.
n. Williams Bros. Corporation of America (The).

2. Description: Face of door flush with frame, with exposed flange and concealed hinge.
3. Locations: All ceramic tile surfaces, stone tile surfaces, and plastic paneling surfaces.
4. Door Size: As indicated or, if not indicated, as required to gain access to concealed plumbing, mechanical, or other concealed work.
5. Stainless Steel Sheet for Door: 0.0625 inch (1.59 mm) (16 gage nominal), ASTM A480/A480M No. 4 finish.
6. Frame Material: Same material, thickness, and finish as door.
7. Hinges: Spring-loaded, concealed-pin type.
8. Latch and Lock: Latch bolt, cylinder lock, key operated, with interior release.

B. Flush Access Doors with Concealed Flanges:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Acudor Products, Inc.
b. Babcock-Davis.
c. Cendrex Inc.
d. Elmdor/Stoneman Manufacturing Company; a division of Acorn Engineering Company.
e. JL Industries, Inc.; a division of the Activar Construction Products Group.
f. Karp Associates, Inc.
g. Lane-Aire Manufacturing Corp.
h. Larsens Manufacturing Company.
i. Maxam Metal Products Limited.
j. Metropolitan Door Industries Corp.
k. MIFAB, Inc.
l. Milcor; Commercial Products Group of Hart & Cooley, Inc.
m. Nystrom, Inc.
n. Williams Bros. Corporation of America (The).

2. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
3. Locations: Wall and ceiling surfaces unless otherwise indicated.
4. Door Size: As indicated or, if not indicated, as required to gain access to concealed plumbing, mechanical, or other concealed work.
5. Metallic-Coated Steel Sheet for Door: 0.0635 inch (1.61 mm) (16 gage nominal), factory primed.
6. Frame Material: Same material, thickness, and finish as door.
7. Hinges: Spring-loaded, concealed-pin type.
8. Latch and Lock: Latch bolt, cylinder lock, key operated, with interior release.

2.5 EXTERIOR ACCESS DOORS AND FRAMES

A. Exterior Flush Access Doors with Exposed Flanges:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Babcock-Davis.
b. JL Industries, Inc.; a division of the Activar Construction Products Group.
c. Karp Associates, Inc.
d. Larsens Manufacturing Company.
e. Maxam Metal Products Limited.
f. MIFAB, Inc.
g. Nystrom, Inc.
h. Williams Bros. Corporation of America (The).

2. Description: Weatherproof assembly, with face of door fit flush with frame and with exposed frame. Include extruded door gaskets and not less than 2 inch (50 mm) thick fiberglass insulation.
3. Locations: Wall and soffit surfaces unless otherwise indicated.
4. Door Size: As indicated or, if not indicated, as required to gain access to concealed plumbing, mechanical, or other concealed work.
5. Stainless Steel Sheet for Door: 0.0625 inch (1.59 mm) (16 gage nominal), ASTM A480/A480M No. 4 finish.
6. Frame Material: Same material, thickness, and finish as door.
7. Hinges: Spring-loaded, concealed-pin type.
8. Latch and Lock: Latch bolt, cylinder lock, key operated, with interior release.

2.6 INTERIOR FIRE-RATED ACCESS DOORS AND FRAMES

A. Fire-Rated, Flush Access Doors with Exposed Flanges:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Acudor Products, Inc.
b. Babcock-Davis.
c. Cendrex Inc.
d. Elmdor/Stoneman Manufacturing Company; a division of Acorn Engineering Company.
e. JL Industries, Inc.; a division of the Activar Construction Products Group.
f. Karp Associates, Inc.
g. Lane-Aire Manufacturing Corp.
h. Larsens Manufacturing Company.
i. Maxam Metal Products Limited.
j. Metropolitan Door Industries Corp.
k. MIFAB, Inc.
l. Milcor; Commercial Products Group of Hart & Cooley, Inc.
m. Nystrom, Inc.
n. Williams Bros. Corporation of America (The).

2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal; with exposed flange, self-closing door, and concealed hinge.
3. Locations: All ceramic tile surfaces, stone tile surfaces, and plastic paneling surfaces.
4. Door Size: As indicated or, if not indicated, as required to gain access to concealed plumbing, mechanical, or other concealed work.
5. Fire-Resistance Rating: Not less than that of adjacent construction.
6. Temperature-Rise Rating: 450 deg F (250 deg C) at the end of 30 minutes.
7. Stainless Steel Sheet for Door: 0.0375 inch (0.95 mm) (20 gage nominal), ASTM A480/A480M No. 4 finish.
8. Frame Material: Same material, thickness, and finish as door.

9. Hinges: Spring-loaded, concealed-pin type.
10. Latch and Lock: Self-closing, self-latching, door hardware, cylinder lock, key operated, with interior release.

B. Fire-Rated, Flush Access Doors with Concealed Flanges:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Acudor Products, Inc.
    b. Babcock-Davis.
    c. Cendrex Inc.
    d. JL Industries, Inc.; a division of the Activar Construction Products Group.
    e. Karp Associates, Inc.
    f. Maxam Metal Products Limited.
    g. Metropolitan Door Industries Corp.
    h. MIFAB, Inc.
    i. Nystrom, Inc.
    j. Williams Bros. Corporation of America (The).

2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal; with concealed flange for gypsum board installation, self-closing door, and concealed hinge.
3. Locations: Wall and ceiling surfaces unless otherwise indicated.
4. Door Size: As indicated or, if not indicated, as required to gain access to concealed plumbing, mechanical, or other concealed work.
5. Fire-Resistance Rating: Not less than that of adjacent construction.
6. Temperature-Rise Rating: 450 deg F (250 deg C) at the end of 30 minutes.
7. Metallic-Coated Steel Sheet for Door: 0.0396 inch (1.01 mm) (20 gage nominal), factory primed.
8. Frame Material: Same material, thickness, and finish as door.
9. Hinges: Spring-loaded, concealed-pin type.
10. Latch and Lock: Self-closing, self-latching, door hardware, cylinder lock, key operated, with interior release.

2.7 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

D. Stainless Steel Sheet, Strip, Plate, and Flat Bars: ASTM A666, Type 304. Remove tool and die marks and stretch lines, or blend into finish.

E. Frame Anchors: Same material as door face.

F. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.8 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.

D. Latch and Lock Hardware:

1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
2. Keys: Furnish two keys per lock and key all locks alike.

2.9 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

E. Stainless Steel Finishes:

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finish: ASTM A480/A480M No. 4 finish. Grind and polish surfaces to produce uniform finish, free of cross scratches.

a. Run grain of directional finishes with long dimension of each piece.
b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Owner will engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:

1. Fire-Rated Door Inspections: Inspect each fire-rated access door in accordance with NFPA 80, section 5.2.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated access door indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

3.5 REPAIR

A. Prime-Coat Touchup for Interior Doors and Frames: Immediately after installation, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 083113

This page intentionally left blank.

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Storefront framing.
2. Manual-swing entrance doors.

B. Related Requirements:

1. Section 084413 "Glazed Aluminum Curtain Walls" for aluminum-framed curtain walls.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:

a. Joinery, including concealed welds.
b. Anchorage.
c. Expansion provisions.
d. Glazing.
e. Flashing and drainage.

3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

E. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For door inspector.

a. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
b. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.

2. For Installer.

B. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.

1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.

C. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by a qualified testing agency.

D. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Egress Door Inspector Qualifications: Inspector for field quality control inspections of egress door assemblies shall meet the qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.8 MOCKUPS

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical wall area as indicated on Drawings or, if not indicated, as directed by Architect.
2. Testing shall be performed on mockups according to requirements in "Field Quality Control" Article.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 WARRANTY

A. Special Warranty: Manufacturer and Installer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including, but not limited to, excessive deflection.
b. Noise or vibration created by wind and thermal and structural movements.
c. Deterioration of metals and other materials beyond normal weathering.
d. Water penetration through fixed glazing and framing areas.
e. Failure of operating components.

2. Warranty Period: Five years from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.2 ACCESSIBILITY REQUIREMENTS

A. Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

B. Doors, Doorways, and Gates:

1. General: Doors, doorways, and gates that are part of an accessible route shall comply with CBC Section 11B-404 per CBC Section 11B-404.1.

a. Exceptions:

1) Doors, doorways, and gates designed to be operated only by security personnel shall not be required to comply with CBC Sections 11B-404.2.7, 11B-404.2.8, 11B-4042.9, 11B-404.3.2, and 11B-404.3.4 through 11B-404.3.7. A sign visible from the approach side complying with CBC Section 11B-703.5 shall be posted stating "ENTRY RESTRICTED AND CONTROLLED BY SECURITY PERSONNEL."
2) At detention and correctional facilities, doors, doorways, and gates designed to be operated only by security personnel shall not be required to comply with CBC Sections 11B-404.2.7, 11B-404.2.8, 11B-4042.9, 11B-404.3.2, and 11B-404.3.4 through 11B-404.3.7.

2. Manual Doors, Doorways, and Manual Gates: Manual doors and doorways and manual gates intended for user passage shall comply with CBC Section 11B-404.2 per CBC Section 11B-404.2.

a. Revolving Doors, Gates, and Turnstiles: Revolving doors, revolving gates, and turnstiles shall not be part of an accessible route per CBC Section 11B-404.2.1.
b. Double-Leaf Doors and Gates: At least one of the active leaves of doorways with two leaves shall comply with CBC Sections 11B-404.2.3 and 11B-404.2.4 per CBC Section 11B-404.2.2.
c. Clear Width: Openings shall provide a clear width of 32 inches (813 mm) minimum. Clear openings of doorways with swinging doors shall be measured between the face of the door and the stop, with the door open 90 degrees. Openings more than 24 inches (610 mm) deep shall provide a clear opening of 36 inches (914 mm) minimum. There shall be no projections into the required clear opening width lower than 34 inches (864 mm) above the finish floor or ground. Projections into the clear opening width between 34 inches (864 mm) and 80 inches (2032 mm) above the finish floor or ground shall not exceed 4 inches (102 mm) per CBC Section 11B-404.2.3 and CBC Figure 11B-404.2.3.

1) Exceptions:

a) In alterations, a projection of 5/8 inch (15.9 mm) maximum into the required clear width shall be permitted for the latch side stop.
b) Door closers and door stops shall be permitted to be 78 inches (1981 mm) minimum above the finish floor or ground.

d. Maneuvering Clearances: Minimum maneuvering clearances at doors and gates shall comply with CBC Section 11B-404.2.4. Maneuvering clearances shall extend the full width of the doorway and the required latch side or hinge side clearance per CBC Section 11B-404.2.4.

1) Swinging Doors and Gates: Swinging doors and gates shall have maneuvering clearances complying with CBC Table 11B-404.2.4.1 per CBC Section 11B-404.2.4.1.
2) Doorways Without Doors or Gates, Sliding Doors, and Folding Doors: Doorways less than 36 inches (914 mm) wide without doors or gates, sliding doors, or folding doors shall have maneuvering clearances complying with CBC Table 11B-404.2.4.2 per CBC Section 11B-404.2.4.2.
3) Recessed Doors and Gates: Maneuvering clearances for forward approach shall be provided when any obstruction within 18 inches (457 mm) of the latch side at an interior doorway, or within 24 inches (610 mm) of the latch side of an exterior doorway, projects more than 8 inches (203 mm) beyond the face of the door, measured perpendicular to the face of the door or gate per CBC Section 11B-404.2.4.3.
4) Floor or Ground Surface: Floor or ground surface within required maneuvering clearances shall comply with CBC Section 11B-302. Changes in level are not permitted per CBC Section 11B-404.2.4.4.
   a) Exception:

      1. Slopes not steeper than 1:48 shall be permitted.
      2. Changes in level at thresholds complying with CBC Section 11B-404.2.5 shall be permitted.

e. Thresholds: Thresholds, if provided at doorways, shall be 1/2 inch (12.7 mm) high maximum. Raised thresholds and changes in level at doorways shall comply with CBC Sections 11B-302 and 11B-303 per CBC Section 11B-404.2.5.
f. Doors in a Series and Gates in a Series: The distance between two hinged or pivoted doors in series and gates in series shall be 48 inches (1219 mm) minimum plus the width of the doors or gates swinging into the space per CBC Section 11B-404.2.6.
g. Door and Gate Hardware: Handles, pulls, latches, locks, and other operable parts on doors and gates shall comply with CBC Section 11B-309.4. Operable parts of such hardware shall be 34 inches (864 mm) minimum and 44 inches (1118 mm) maximum above the finish floor or ground. Where sliding doors are in the fully open position, operating hardware shall be exposed and usable from both sides per CBC Section 11B-404.2.7.

1) Exceptions:

   a) Existing locks shall be permitted in any location at existing glazed doors without stiles, existing overhead rolling doors or grilles, and similar existing doors or grilles that are designed with locks that are activated only at the top or bottom rail.
   b) Access gates in barrier walls and fences protecting pools, spas, and hot tubs shall be permitted to have operable parts of the release latch on self-latching devices at 54 inches (1372 mm) maximum above the finish floor or ground provided the self-latching devices are not also self-locking devices and operated by means of a key, electronic opener, or integral combination lock.

2) Operation: Operable parts shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate operable parts shall be 5 pounds (22.2 N) maximum per CBC Section 11B-309.4.

h. Closing Speed: Door and gate closing speed shall comply with CBC Section 11B-404.2.8 per CBC Section 11B-404.2.8.

1) Door Closers and Gate Closers: Door closers and gate closers shall be adjusted so that from an open position of 90 degrees, the time required to move the door to a position of 12 degrees from the latch is 5 seconds minimum per CBC Section 11B-404.2.8.1.
2) Spring Hinges: Door and gate spring hinges shall be adjusted so that from the open position of 70 degrees, the door or gate shall move to the closed position in 1.5 seconds minimum per CBC Section 11B-404.2.8.2.

i. Door and Gate Opening Force: The force for pushing or pulling open a door or gate shall be as follows per CBC Section 11B-404.2.9:

1) Interior Hinged Doors and Gates: 5 pounds (22.2 N) maximum.
2) Sliding or Folding Doors: 5 pounds (22.2 N) maximum.
3) Required Fire Doors: The minimum opening force allowable by the appropriate administrative authority, not to exceed 15 pounds (66.7 N).
4) Exterior Hinged Doors: 5 pounds (22.2 N) maximum.
5) These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door or gate in a closed position.
6) Operation: Operable parts shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate operable parts shall be 5 pounds (22.2 N) maximum per CBC Section 11B-309.4.
7) Door Opening Force: The force for pushing or pulling open interior swinging egress doors, other than fire doors, shall not exceed 5 pounds (22.2 N). These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position. For other swinging doors, as well as sliding and folding doors, the door latch shall release when subjected to a 15 pound (67 N) force. The door shall be set in motion when subjected to a 30 pound (133 N) force. The door shall swing to a full-open position when subjected to a 15 pound (67 N) force per CBC Section 1010.1.3.

a) Location of Applied Forces: Forces shall be applied to the latch side of the door per CBC Section 1010.1.3.1.

j. Door and Gate Surfaces: Swinging door and gate surfaces within 10 inches (254 mm) of the finish floor or ground measured vertically shall have a smooth surface on the push side extending the full width of the door or gate. Parts creating horizontal or vertical joints in these surfaces shall be within 1/16 inch (1.6 mm) of the same plane as the other and be free of sharp or abrasive edges. Cavities created by added kick plates shall be capped per CBC Section 11B-404.2.10.

1) Exceptions:

a) Sliding doors shall not be required to comply with CBC Section 11B-404.2.10.
b) Tempered glass doors without stiles and having a bottom rail or shoe with the top leading edge tapered at 60 degrees minimum from the horizontal shall not be required to meet the 10 inch (254 mm) bottom smooth surface height requirement.
c) Doors and gates that do not extend to within 10 inches (254 mm) of the finish floor or ground shall not be required to comply with CBC Section 11B-404.2.10.

k. Vision Lights (Lites): Doors, gates, and side lights (lites) adjacent to doors or gates, containing one or more glazing panels that permit viewing through the panels shall have the bottom of at least one glazed panel located 43 inches (1092 mm) maximum above the finish floor per CBC Section 11B-404.2.11.

1) Exception: Glazing panels with the lowest part more than 66 inches (1676 mm) from the finish floor or ground shall not be required to comply with CBC Section 11B-404.2.11.

2.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

C. Structural Loads:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.

D. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19.1 mm), whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller.

a. Operable Units: Provide not less than 1/16 inch (1.6 mm) clearance between framing members and operable units.

3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:

a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 11 feet 8-1/4 inches (3.6 m) or 1/175 times span, for spans of less than 11 feet 8-1/4 inches (3.6 m).

E. Structural: Test according to ASTM E330/E330M as follows:

1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Air Infiltration: Test according to ASTM E283 for infiltration as follows:

1. Fixed Framing and Glass Area:

   a. Maximum air leakage of 0.06 cfm/sq. ft. (0.30 L/s per sq. m) at a static-air-pressure differential of 6.24 lbf/sq. ft. (300 Pa).

2. Entrance Doors:

   a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. (5.08 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).
   b. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. (2.54 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).

G. Water Penetration under Static Pressure: Test according to ASTM E331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).

H. Interstory Drift: Accommodate design displacement of adjacent stories indicated.

1. Design Displacement: As indicated on Drawings.
2. Test Performance: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.4 at design displacement and 1.5 times the design displacement.

I. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.6 at design displacement and 1.5 times the design displacement.
2. Vertical Interstory Movement: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.7 at design displacement and 1.5 times the design displacement.

J. Energy Performance: Certify and label energy performance according to NFRC as follows:

1. Thermal Transmittance (U-factor): Fixed glazing and framing areas as a system shall have U-factor of not more than that indicated on Drawings as determined according to NFRC 100.
2. Solar Heat Gain Coefficient (SHGC): Fixed glazing and framing areas as a system shall have SHGC of not more than that indicated on Drawings as determined according to NFRC 200.
3. Condensation Resistance: Fixed glazing and framing areas as a system shall have an NFRC-certified condensation resistance rating of not less than that indicated on Drawings as determined according to NFRC 500.

K. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

    a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F (82 deg C).
    b. Low Exterior Ambient-Air Temperature: 0 deg F (minus 18 deg C).
    c. Interior Ambient-Air Temperature: 75 deg F (24 deg C).

2.4 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Recycled Content of Steel Products: Recycled content not less than 20 percent.

C. Recycled Content of Aluminum Products: Recycled content not less than 20 percent.

D. Regional Materials: Aluminum-framed entrances and storefronts shall be manufactured within 500 miles (800 km) of Project site.

E. Finish Material Pollutant Control: Finish materials shall comply with CGBC Sections 5.504.4.1 through 5.504.4.6 per CGBC Section 5.504.4.

1. Adhesives, Sealants, and Caulks: Adhesives, sealants, and caulks used on the project shall meet the requirements of the following standards per CGBC Section 5.504.4.1:

    a. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in CBC Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products specified in subparagraph below.
    b. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

2. Sealants and sealant primers shall comply with maximum VOC limits listed in CGBC Table 5.504.4.2.

F. VOC Content: Sealants and sealant primers shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Architectural Sealants: 250 g/L.
2. Architectural Sealant Primers for Nonporous Substrates: 250 g/L.
3. Architectural Sealant Primers for Porous Substrates: 775 g/L.

G. Low-Emitting Materials: Sealants and sealant primers shall comply with the requirements of authorities having jurisdiction.

H. Low-Emitting Materials: Paints and coatings shall comply with the requirements of authorities having jurisdiction.

2.5 STOREFRONT SYSTEMS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Arcadia, Inc.; AFG451T Series, 2 inch by 4-1/2 inch, Thermally Broken; Offset Glazed System, Glazed for 1 inch glass, or a comparable product by one of the following:

1. CMI Architectural.
2. Commercial Architectural Products, Inc.
3. Coral Industries, Inc.
4. EFCO Corporation.
5. Kawneer North America, an Arconic company.
6. Leed Himmel Industries, Inc.
7. Manko Window Systems, Inc.
8. Oldcastle BuildingEnvelope™.
9. Pittco Architectural Metals, Inc.
10. SAFTI FIRST Fire Rated Glazing Solutions.
11. Trulite Glass & Aluminum Solutions, LLC.
12. Tubelite Inc.
13. U.S. Aluminum; a brand of C.R. Laurence.
14. YKK AP America Inc.

B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Exterior Framing Construction: Thermally broken.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: As indicated on Drawings.
4. Finish: High-performance organic finish.
5. Fabrication Method: Field-fabricated stick system.
6. Steel Reinforcement: As required by manufacturer.

C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.6 ENTRANCE DOOR SYSTEMS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Arcadia, Inc.; WS512 HD Series, Heavy Duty Door, 1-3/4 inches thick, Glazed for 1 inch glass, or a comparable product by one of the following:

1. CMI Architectural.
2. Commercial Architectural Products, Inc.
3. Coral Industries, Inc.
4. EFCO Corporation.

5. Kawneer North America, an Arconic company.
6. Leed Himmel Industries, Inc.
7. Manko Window Systems, Inc.
8. Oldcastle BuildingEnvelope™.
9. Pittco Architectural Metals, Inc.
10. SAFTI FIRST Fire Rated Glazing Solutions.
11. Trulite Glass & Aluminum Solutions, LLC.
12. Tubelite Inc.
13. U.S. Aluminum; a brand of C.R. Laurence.
14. YKK AP America Inc.

B. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.

1. Door Construction: 1-3/4 inch (44.5 mm) overall thickness, with not less than 0.125 inch (3.2 mm) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

2. Door Design: Wide stile; 5 inch (127 mm) nominal width.
3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

a. Provide nonremovable glazing stops on outside of door.

2.7 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."

2.8 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

2.9 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B209 (ASTM B209M).
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221 (ASTM B221M).
3. Extruded Structural Pipe and Tubes: ASTM B429/B429M.
4. Structural Profiles: ASTM B308/B308M.

B. Steel Reinforcement:

1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.

3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.
4. Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

2.10 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system, fabricated from 300 series stainless steel.

B. Anchors: Three-way adjustable anchors with adjustment of not less than 1 inch (25.4 mm) that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30 mil (0.762 mm) thickness per coat.

2.11 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Fabricate components to resist water penetration as follows:

1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within aluminum-framed entrances and storefronts to exterior.

F. Entrance and Storefront Framing: Fabricate components for assembly using manufacturers standard system.

G. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At interior and exterior doors, provide compression weather stripping at fixed stops.
2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

H. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

I. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

J. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.12 ALUMINUM FINISHES

A. High-Performance Organic Finish: Three-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF or FEVE resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

E. Install glazing as specified in Section 088000 "Glazing."

F. Entrance Doors:
1. Install doors level and plumb, securely anchored, and without distortion.
2. Install doors to produce smooth operation and tight fit at contact points.
3. Adjust weather-stripping contact and hardware movement to produce proper operation.
4. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
5. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.3 ERECTION TOLERANCES

A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
2. Level: 1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
3. Alignment:

   a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
   b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).
   c. Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).

4. Location: Limit variation from plane to 1/8 inch in 12 feet (3.2 mm in 3.6 m); 1/2 inch (12.7 mm) over total length.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and to furnish reports to Architect.

B. Inspections:

1. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements according to NFPA 101, Section 7.2.1.15.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each egress door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

F. Field Quality-Control Testing: Perform the following test on mockups.

1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

G. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.

H. Prepare test and inspection reports.

3.5 MAINTENANCE SERVICE

A. Entrance Door Hardware:

1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.
2. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Use parts and supplies that are the same as those used in the manufacture and installation of original equipment.

3.6 ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.

1. For entrance doors accessible to people with disabilities, adjust closers so that from an open position of 90 degrees, the time required to move the door to a position of 12 degrees from the latch is not less than 5 seconds.

2. For entrance doors accessible to people with disabilities, adjust spring hinges so that from the open position of 70 degrees, the time required to move the door to the closed position in not less than 1.5 seconds.

END OF SECTION 084113

SECTION 086200 - UNIT SKYLIGHTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Unit skylights mounted on site-erected curbs.

B. Related Requirements:

1. Section 086226 "Tubular Daylighting Devices" for skylights with reflective tube.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of unit skylight.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for unit skylights.

B. Shop Drawings: For unit skylight work.

1. Include plans, elevations, sections, details, and connections to supporting structure and other adjoining work.

C. Aluminum Finish Samples: For each type of exposed finish required, in a representative section of each unit skylight in manufacturer's standard size.

D. Glazing Samples: For each color and finish of glazing indicated, 12 inches (300 mm) square and of same thickness indicated for the final Work.

E. Product Schedule: For unit skylights. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and manufacturer.

B. Product Test Reports: For each type and size of unit skylight, for tests performed within the last four years by a qualified testing agency. Test results based on testing of smaller unit skylights than specified will not be accepted.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For unit skylights to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating unit skylights that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.

B. Installer Qualifications: An installer acceptable to unit skylight manufacturer for installation of units required for this Project.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of unit skylights that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Uncontrolled water leakage.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
c. Breakage of glazing.
d. Deterioration of insulating-glass hermetic seal.

2. Warranty Period:

a. Unit Skylight and Flashing Warranty: 10 years from date of Substantial Completion.
b. Unit Skylight and Flashing Installation "No Leak" Warranty: 10 years from date of Substantial Completion.
c. Hail Breakage Warranty for Skylight Glass: 10 years from date of Substantial Completion on all insulated glass units using laminated glass.
d. Insulating Glass Seal Failure Warranty: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Velux America, LLC; Model FCM, Fixed Curb Mount Skylight, or a comparable product by one of the following:

1. American Skylites Inc.
2. Auburn Skylights.
3. C/S Groups.
4. CPI International.
5. Dur-Red Products.
6. Energy-Glazed Systems, Inc.
7. Exarc Skylights, Inc.
8. Fiore Skylights, Inc.
9. Fox Lite, Inc.
10. Kalwall Corporation.
11. Kingspan Light + Air, North America.
12. Lane-Aire Manufacturing Corp.
13. Plasteco, Inc.
14. Plastic Engineering Company of Tulsa, Inc.
15. Skyline Sky-Lites, LLC.
16. Solar Industries, Inc.
17. Sunglo Skylight Products.
18. Sunoptics.
19. Wasco Skylights - Part of the VELUX Group.
20. Wisconsin Solar Design Inc.

2.2 PERFORMANCE REQUIREMENTS

A. Unit Skylight Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Performance Class and Grade: Class CW-PG 90.
2. Certification: AAMA-, WDMA-, or CSA-certified unit skylights with label attached to each.

B. Thermal Transmittance: NFRC 100 maximum U-factor of 0.50 Btu/sq. ft. x h x deg F (2.83 W/sq. m x K).

C. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum SHGC of 0.27.

2.3 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Recycled Content of Aluminum Products: Recycled content not less than 20 percent.

C. Finish Material Pollutant Control: Finish materials shall comply with CGBC Sections 5.504.4.1 through 5.504.4.6 per CGBC Section 5.504.4.

1. Adhesives, Sealants, and Caulks: Adhesives, sealants, and caulks used on the project shall meet the requirements of the following standards per CGBC Section 5.504.4.1:

    a. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in CBC Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products specified in subparagraph below.
    b. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

2. Sealants and sealant primers shall comply with maximum VOC limits listed in CGBC Table 5.504.4.2.

D. VOC Content: Sealants and sealant primers shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Architectural Sealants: 250 g/L.
2. Architectural Sealant Primers for Nonporous Substrates: 250 g/L.
3. Architectural Sealant Primers for Porous Substrates: 775 g/L.

E. Low-Emitting Materials: Sealants and sealant primers shall comply with the requirements of authorities having jurisdiction.

F. Low-Emitting Materials: Paints and coatings shall comply with the requirements of authorities having jurisdiction.

2.4 UNIT SKYLIGHTS

A. General: Provide factory-assembled unit skylights that include glazing, extruded-aluminum glazing retainers, gaskets, and inner frames and that are capable of withstanding performance requirements indicated.

B. Unit Shape and Size: As indicated on Drawings.

C. Low-E-Coated, Tinted, Insulating, Laminated Glass: Low-E-coated, tinted, insulating, laminated glass, sealed units that comply with Section 088000 "Glazing," in manufacturer's standard overall thickness.

1. Outdoor Lite: Tinted, fully tempered, Low-E-coated, float glass.

    a. Basis-of-Design Product: PPG Industries, Inc.; Solarban 70XL Solargray Solar Control Low-E Glass.
    b. Minimum Thickness of Outdoor Glass Lite: 6 mm.
    c. Tint Color: Gray.
    d. Low-E Coating: Pyrolytic or sputtered on second surface.

2. Interspace Content: Air.
3. Indoor Lite: Clear laminated glass with two plies of fully tempered float glass.

a. Minimum Thickness of Each Glass Ply: 3 mm.
b. Interlayer Thickness: 0.030 inch (0.76 mm).

4. Provide safety glazing where indicated and where required.

D. Glazing Gaskets: Manufacturer's standard.

E. Condensation Control: Fabricate unit skylights with integral internal gutters and nonclogging weeps to collect and drain condensation to the exterior.

F. Thermal Break: Fabricate unit skylights with thermal barrier separating exterior and interior metal framing.

G. Protective Screens: Metal screen system attached to outer frame of skylights to comply with CalOSHA Standard 29 CFR 1910.23 (a)(4) and 29 CFR 1910.23 (e)(8).

1. Basis-of-Design Product: Simplified Safety Inc.; Model STS, Skylight Fall Protection Screens for Domed Skylights.

2.5 ACCESSORY MATERIALS

A. Fasteners: Same metal as metal being fastened, nonmagnetic stainless steel, or other noncorrosive metal as recommended by manufacturer. Finish exposed fasteners to match material being fastened.

1. Where removal of exterior exposed fasteners might allow access to building, provide nonremovable fastener heads.

B. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat.

2.6 ALUMINUM FINISHES

A. High-Performance Organic Finish: Three-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate installation of unit skylight with installation of substrates, vapor retarders, roof insulation, roofing membrane, and flashing as required to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight.

B. Comply with recommendations in AAMA 1607 and with manufacturer's written instructions for installing unit skylights.

C. Install unit skylights level, plumb, and true to line, without distortion.

D. Anchor unit skylights securely to supporting substrates.

E. Where aluminum surfaces of unit skylights will contact another metal or corrosive substrates, such as preservative-treated wood, apply bituminous coating on concealed metal surfaces or provide other approved permanent separation recommended in writing by unit skylight manufacturer.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. After completion of installation and nominal curing of sealant and glazing compounds but before installation of interior finishes, test for water leaks according to AAMA 501.2.

C. Perform test for total area of each unit skylight.

D. Work will be considered defective if it does not pass tests and inspections.

E. Additional testing and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

F. Prepare test and inspection reports.

3.4 CLEANING

A. Clean exposed unit skylight surfaces according to manufacturer's written instructions. Touch up damaged metal coatings and finishes.

B. Remove excess sealants, glazing materials, dirt, and other substances.

C. Remove and replace glazing that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect unit skylight surfaces from contact with contaminating substances resulting from construction operations.

END OF SECTION 086200

SECTION 086226 - TUBULAR DAYLIGHTING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Tubular daylighting devices.
2. Accessories.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood blocking, cants, and nailers.
2. Section 075419 "Polyvinyl-Chloride (PVC) Roofing" for flashing of skylight base.
3. Section 076200 "Sheet Metal Flashing and Trim" for metal curb flashings.
4. Section 086200 "Unit Skylights" for skylights without reflective tube.
5. Division 23 Sections for fan vent duct and connections.
6. Division 26 Sections for lighting controllers, power cable, power supply, electrical connections, control cable, dimming controls, light bulbs, and lamps.

1.03 REFERENCES

A. ASTM International (ASTM):

1. ASTM A463/A463M "Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process."
2. ASTM A653/A653M "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process."
3. ASTM A792/A792M "Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process."
4. ASTM B209 "Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate."
5. ASTM D635 "Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position."
6. ASTM D1929 "Standard Test Method for Determining Ignition Temperature of Plastics."
7. ASTM D2843 "Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics."
8. ASTM E84 "Standard Test Method for Surface Burning Characteristics of Building Materials."
9. ASTM E108 "Standard Test Methods for Fire Tests of Roof Coverings."
10. ASTM E283 "Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen."
11. ASTM E308 "Standard Practice for Computing the Colors of Objects by Using the CIE System."

12. ASTM E330/E330M "Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference."
13. ASTM E547 "Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference."
14. ASTM E1886 "Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials."
15. ASTM E1996 "Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes."
16. ASTM F1642/F1642M "Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings."
17. ASTM F2912 "Standard Specification for Glazing and Glazing Systems Subject to Airblast Loadings."

B. American Architectural Manufacturers Association (AAMA), the Window & Door Manufacturers Association (WDMA), and the Canadian Standards Association (CSA):

1. AAMA/WDMA/CSA 101/I.S.2/A440 "NAFS – North American Fenestration Standard/Specification for windows, doors, and skylights."

C. FM Global Group (FM):

1. FM Approval Standard 4431 "Skylights."

D. Underwriters Laboratories Inc. (UL):

1. UL 181 "Standard for Factory-Made Air Ducts and Air Connectors."
2. UL 2108 "Standard for Low Voltage Lighting Systems."

E. US General Services Administration (GSA):

1. GSA-TS01 "Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings."

F. Unified Facilities Criteria (UFC):

1. UFC 4-010-01 "DoD Minimum Antiterrorism Standards for Buildings, with Change 1."

G. Canadian Standards Association (CSA):

1. C22.2 No. 250.0 "Luminaires."

H. International Code Council (ICC):

1. AC16 "Acceptance Criteria for Plastic Glazed Skylights."

I. Florida Building Code (FBC):

1. TAS 201 "Impact Test Procedures."
2. TAS 202 "Criteria for Testing Impact & Nonimpact Resistant Building Envelope Components Using Uniform Static Air Pressure."
3. TAS 203 "Criteria for Testing Products Subject to Cyclic Wind Pressure Loading."

J. International Building Code (IBC):

1. Section 1710 "Load Test Procedure for Wind Load Testing on Rooftop Daylight Collecting System - Structural Performance Testing (Devised by ATI PE)."
2. Section 2606.7.2 "Installation - Diffuser Fall Out Test (Devised by PE)."

K. Occupational Safety and Health Administration (OSHA):

1. OSHA 29 CFR 1910.23 (e)(8) (Guarding Requirements for Skylights).
2. OSHA 29 CFR 1926 Subpart M (Fall Protection).
3. OSHA 29 CFR 1926.501(b)(4)(i).
4. OSHA 29 CFR 1926.501(i)(2).
5. OSHA 29 CFR 1926.501(b)(4)(ii).

L. State of California, Department of Industrial Relations, Division of Occupational Safety and Health (Cal/OSHA):

1. Fall Protection Code of Regulations, Title 8, Section 3212 (e)(1)

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of tubular daylighting device showing roof dome assembly, flashing base, reflective tubes, diffuser assembly, and accessories.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for tubular daylighting devices.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Installation methods.

B. Shop Drawings: For tubular daylighting device work showing layout, profiles and product components, including rough opening and framing dimensions, anchorage, roof flashings and accessories.

1. Include plans, elevations, sections, details, and connections to supporting structure and other adjoining work.
2. Electrical wiring diagrams and recommendations for power and control wiring.

C. Finish Samples: For each type of exposed finish required, in a representative section of each tubular daylighting device in manufacturer's standard size.

D. Glazing Samples: For each color and finish of glazing indicated, in manufacturer's standard size and of same thickness indicated for the final Work.

E. Product Schedule: For tubular daylighting devices. Use same designations indicated on Drawings.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and manufacturer.

B. Product Test Reports: For each type and size of tubular daylighting device, for tests performed within the last four years by a qualified testing agency verifying compliance with specified performance requirements. Test results based on testing of smaller tubular daylighting devices than specified will not be accepted.

C. Evaluation Reports: For tubular daylighting devices, from ICC-ES.

D. Sample Warranty: For special warranty.

1.07 CLOSEOUT SUBMITTALS

A. Maintenance Data: For tubular daylighting devices to include in maintenance manuals.

1.08 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating tubular daylighting devices that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.

1. Engaged in manufacture of tubular daylighting devices for not less than 20 years.

B. Installer Qualifications: Manufacturer or an installer acceptable to tubular daylighting device manufacturer for installation of units required for this Project.

1. Installer shall be an approved certified installer of the manufacturer.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original containers, dry, undamaged, seals and labels intact.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of authorities having jurisdiction.

1.10 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of tubular daylighting devices that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Uncontrolled water leakage.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
c. Yellowing of acrylic glazing.
d. Breakage of polycarbonate glazing.

2. Warranty Period: 10 years from date of Substantial Completion.

B. Special Warranty: Manufacturer agrees to repair or replace electrical parts that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 5 years from date of Substantial Completion.

C. Special Warranty: Manufacturer agrees to repair or replace LED emitters, drivers and controls that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 3 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain tubular daylighting devices and accessories, from single source from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

A. Daylight Reflective Tubes: Spectralight Infinity with INFRAREDuction Technology combines ultra-high Visible Light reflectance with Ultra-low Infrared (IR) reflectance. Patented spectrally-selective optical surface yields an average total- and specular-reflectance greater than 99.5 percent for the Visible Light spectrum (400 nm to 700 nm) providing maximized visible light transmission and less than 25 percent reflectance for Infrared (IR) heat wavelengths (750 nm to 2500 nm) for minimized heat transmission, resulting in a spectrally-selective Total Solar Spectrum (250 nm to 2500 nm) reflectance less than 37 percent, as measured using a Perkin Elmer Lambda 1050 spectrophotometer with a Universal Reflectance Accessory. Color: a* and b* (defined by CIE L*a*b* color model) shall not exceed plus 2 or be less than minus 2 as determined in accordance to ASTM E308.

B. SolaMaster 750 DS-O / 750 DS-C (Open/Closed Ceiling):

1. AAMA/WDMA/CSA 101/IS2/A440, Class CW-PG70, size tested 21 inch (533 mm) diameter, Type TDDOC and Type TDDCC.

a. Air Infiltration Test:

1) Single and Dual Glazed Dome (M74 DS Type DP & DPP): Passes air infiltration; maximum of 0.05 cfm/sq.ft. (0.3 L/s/sq.m) when tested according to AAMA/WDMA/CSA 101/I.S.2/A440-11, ICC-ES AC16, and ASTM E283.
2) Air infiltration will not exceed 0.30 cfm/sf aperture with a pressure delta of 1.57 psf across the tube when tested in accordance with ASTM E283.
3) Single and Dual Glazed Dome (M74 DS Type DP & DPP): Meets or exceeds the air leakage performance levels with a maximum 0.4 cfm/sq. ft. when tested in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 and ASTM E283.
4) Air exfiltration will not exceed 0.40 cfm/sf aperture with a pressure delta of 1.57 psf across the tube when tested in accordance with ASTM E283.

b. Water Resistance Test:

1) Passes water resistance; no uncontrolled water leakage with a pressure differential of 10.7 psf (512 Pa) or 15 percent of the design load (whichever is greater) and a water spray rate of 5 gallons/hour/sf for 24 minutes when tested in accordance with ASTM E547 and ASTM E331.

c. Uniform Load Test: All units tested with a safety factor of (3) for positive pressure and (2) for negative pressure, acting normal to plane of roof in accordance with ASTM E330.

1) No breakage, permanent damage to fasteners, hardware parts, or damage to make daylighting system inoperable or cause excessive permanent deflection of any section when tested at a positive load of 150 psf (7.18 kPa) or negative load of 70 psf (3.35 kPa).

2. Fire Testing:

a. Fire Rated Roof Assemblies:

1) When used with the Dome Edge Protection Band, all domes meet fire rating requirements as described in the California Building Code for Class A, B, and C roof assemblies.

b. When used with the Dome Edge Protection Band, all domes meet fire rating requirements as described in the California Building Code.
c. Self-Ignition Temperature: Not less than 650 deg F (343 deg C) per ASTM D1929.
d. Smoke Density: Rating not greater than 450 per ASTM E 84 in way intended for use. Classification C.
e. Rate of Burn and/or Extent:

1) Maximum Burning Rate: 2.5 inches/min (62 mm/min) Classification CC-2 per ASTM D 635.
2) Maximum Burn Extent: 1 inch (25 mm) Classification CC-1 per ASTM D 635.

3. Fall Protection Performance:

a. Passes Fall Protection Test: No penetration of dome or curb cap when subject to 400 lb (160 Kg) / 42 inch (1066 mm) impact drop test when tested in accordance with OSHA 29 CFR 1926.506(c) Safety Net Systems.
b. Passes Fall Protection Test: Cal/OSHA Fall Protection Code of Regulations, Title 8, Section 3212 (e)(1) Skylight Screens.

4. Blast Resistance: ASTM F 1642, ASTM F 2912, GSA-TS01, and UFC 4-010-01.

a. Airblast Loading ASTM Hazard Rating: Passes: No Hazard Rating.
b. Airblast Loading UFC Level of Protection: Passes Medium Level of Protection.
c. Dynamic Overpressure Loading ASTM Hazard Rating: Passes: No Hazard Rating.
d. Dynamic Overpressure Loading UFC Level of Protection: Passes Medium Level of Protection.

2.03 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Recycled Content of Steel Products: Recycled content not less than 20 percent.

C. Recycled Content of Aluminum Products: Recycled content not less than 20 percent.

D. Finish Material Pollutant Control: Finish materials shall comply with CGBC Sections 5.504.4.1 through 5.504.4.6 per CGBC Section 5.504.4.

1. Adhesives, Sealants, and Caulks: Adhesives, sealants, and caulks used on the project shall meet the requirements of the following standards per CGBC Section 5.504.4.1:

a. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in CBC Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products specified in subparagraph below.
b. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

2. Sealants and sealant primers shall comply with maximum VOC limits listed in CGBC Table 5.504.4.2.

E. VOC Content: Sealants and sealant primers shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Architectural Sealants: 250 g/L.
2. Architectural Sealant Primers for Nonporous Substrates: 250 g/L.
3. Architectural Sealant Primers for Porous Substrates: 775 g/L.

F. Low-Emitting Materials: Sealants and sealant primers shall comply with the requirements of authorities having jurisdiction.

2.04 TUBULAR DAYLIGHTING DEVICES

A. Tubular Daylighting Devices General: Transparent roof-mounted skylight dome and self-flashing curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces; complying with ICC AC-16.

B. Basis-of-Design Product: Subject to compliance with requirements, provide Solatube International, Inc.; SolaMaster Series, Model 750 DS-C Closed (Penetrating) Ceiling, 21 inch (530 mm) Daylighting System, or a comparable product by another manufacturer.

1. Catalog Number: S750 DS-C-DA-DAI-FC-AK-EXX-E-L2-LN-D-SW-CA.
2. Type: AAMA Type TDDCC.
3. Capture Zone:

a. Roof Dome Assembly: Transparent, UV and impact resistant dome with flashing base supporting dome and top of tube.

1) Outer Dome Glazing: Type DA, not less than 0.125 inch (3.2 mm) thick, injection molded acrylic classified as CC2 material; UV inhibiting (100 percent UV C, 100 percent UV B and 98.5 percent UV A), impact modified acrylic blend.
2) Raybender 3000: Variable prism optic molded into outer dome to capture low angle sunlight and limit high angle sunlight.
3) Inner Dome Glazing: Type DAI, not less than 0.115 inch (3 mm) thick, acrylic classified as CC2 material.

b. Tube Ring: 0.090 inch (2.3 mm) nominal thickness injection molded high impact PVC. Prevents thermal bridging between base flashing and tubing and channel condensed moisture. Attached to base of dome ring with butyl glazing rope 0.24 inch (6 mm) diameter; to minimize air infiltration.
c. Dome Seal: Adhesive backed weatherstrip, 0.63 inch (16 mm) tall by 0.28 inch (7 mm) wide.

4. Flashings:

a. Roof Flashing Base:

1) One Piece: One piece, seamless, leak-proof flashing functioning as base support for dome and top of tube. Sheet steel, corrosion resistant conforming to ASTM A 653/A 653M or ASTM A 463/A 463M or ASTM A 792/A 792M, 0.028 inch (0.7 mm) plus or minus 0.006 inch (0.015 mm) thick.

a) Base Style: Type FC, Curb cap, with inside dimensions as required to cover curb. Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."

5. Transfer Zone:

a. Extension Tubes: Aluminum sheet, 0.018 inch (0.5 mm) thick, conforming to ASTM B 209.

1) Reflective Tubes:

a) Reflective Extension Tube: Type EXX and Type EL with total length of run as indicated on the Drawings.
b) Interior Finish: Spectralight Infinity with INFRAREDuction Technology combining ultra-high visible light reflectance with ultra-low infrared (IR) reflectance.

2) Tube Options:

a) Top Tube Angle Adapter and Bottom Tube Angle Adapter Kit: Type AK, reflective 45 degree adjustable top and bottom angle adapters (one each), 16 inches (406 mm) long.

6. Delivery Zone:

a. Diffuser Assemblies for Tubes Penetrating Ceilings: Solatube Model 750 DS-C. Ceiling mounted box transitioning from round tube to square ceiling assembly, supporting light transmitting surface at bottom termination of tube; 23.8 by 23.8 inches (605 by 605 mm) square frame to fit standard suspended ceiling grids or hard ceilings.

1) Round to square transition box made of opaque polymeric material, classified as CC2, Class C, not less than 0.110 inch (2.8 mm) thick.
2) Lens: Type L2 Prismatic lens design to maximize light output and diffusion with extruded aluminum frame and EPDM foam seal to minimize condensation and bug, dirt and air infiltration per ASTM E 283. Visible Light Transmission shall be greater than 90 percent at 0.100 inches (2.5 mm) thick. Classified as CC2.
3) Supplemental Natural Effect Lens: Type LN, acrylic, classified as CC2, Class C, not less than 0.060 inch (1.5 mm) thick, with open cell foam seal to minimize condensation and bug, dirt and air infiltration per ASTM E 283.

7. Accessories:

a. Wire Suspension Kit: Type E, use the wire suspension kit when additional bracing to the structure is required.
b. Local Dimmer Control utilizing a butterfly baffle design of Spectralight Infinity reflective material to minimize shadowing when in use: Provided with dimmer switch and cable.

1) Daylight Dimmer: Type D, electro-mechanically actuated daylight valve; for universal input voltages ranging between 90 and 277 V at 50 or 60 Hz; maximum current draw of 50 ma per unit; controlled by low voltage, series Type T02: circuited, 4 conductor, size 22 cable; providing daylight output between 2 and 100 percent. Provided with dimmer switch and cable.
2) Switch: Type SW, manufacturer-specific low voltage DC DP/DT switch (white) required to operate Daylight Dimmer.

a) Note: only one switch is required per set of synchronously controlled dimmers.

3) Cable: Type CA, two conductor low voltage cable (500 foot) for multiple unit DC connection.

2.05 ACCESSORY MATERIALS

A. Fasteners: Same material as metals being fastened, non-magnetic steel, non-corrosive metal of type recommended by manufacturer, or injection molded nylon.

B. Suspension Wire: Steel, annealed, galvanized finish, size and type for application and ceiling system requirement.

C. Sealant: Polyurethane or copolymer based elastomeric sealant as provided or recommended by manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Coordinate requirements for power supply, conduit and wiring.

3.03 INSTALLATION

A. Coordinate installation of tubular daylighting devices with installation of substrates, air and vapor retarders, roof insulation, roofing membrane, and flashing as required to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight.

1. Install flashing to produce weatherproof seal with curb and overlap with roofing system termination at top of curb.
2. Provide thermal isolation when components penetrate or disrupt building insulation. Pack fibrous insulation in rough opening to maintain continuity of thermal barriers.
3. Coordinate attachment and seal of perimeter air and vapor barrier material.

B. Comply with recommendations in AAMA 1607 and with manufacturer's written instructions for installing tubular daylighting devices.

C. Install tubular daylighting devices level, plumb, and true to line, without distortion.

1. Align tubular daylighting devices free of warp or twist, maintain dimensional tolerances.

D. Anchor tubular daylighting devices securely to supporting substrates.

E. Where aluminum surfaces of tubular daylighting devices will contact another metal or corrosive substrates, such as preservative-treated wood, apply coating on concealed metal surfaces or provide other approved permanent separation recommended in writing by tubular daylighting device manufacturer.

3.04 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. After completion of installation and nominal curing of sealant and glazing compounds but before installation of interior finishes, test for water leaks according to AAMA 501.2.

C. Perform test for total area of each tubular daylighting device.

D. Work will be considered defective if it does not pass tests and inspections.

E. Additional testing and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

F. Prepare test and inspection reports.

3.05 ADJUSTING

A. Inspect installation to verify secure and proper mounting.

B. Test each tubular daylighting device to verify operation, control functions, and performance.

C. Correct deficiencies.

3.06 CLEANING AND PROTECTION

A. Clean exposed tubular daylighting device surfaces according to manufacturer's written instructions. Touch up damaged metal coatings and finishes.

B. Remove excess sealants, glazing materials, dirt, and other substances.

C. Remove and replace glazing that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect tubular daylighting device surfaces from contact with contaminating substances resulting from construction operations.

E. Tubular Daylighting Device Operating System: Clean and lubricate joints and hardware. Adjust for proper operation.

3.07 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain tubular daylighting device operating system.

END OF SECTION 086226

This page intentionally left blank.

SECTION 087100 – DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Sliding doors.
3. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Door Hardware Schedule”.
2. Division 08 Section “Hollow Metal Doors and Frames”.
3. Division 08 Section “Flush Wood Doors”.
4. Division 28 Section “Access Control”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards:

1. ANSI/BHMA Certified Product Standards - A156 Series
2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

a. Type, style, function, size, label, hand, and finish of each door hardware item.
b. Manufacturer of each item.
c. Fastenings and other pertinent information.
d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
e. Explanation of abbreviations, symbols, and codes contained in schedule.
f. Mounting locations for door hardware.
g. Door and frame sizes and materials.
h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.

b. Complete (risers, point-to-point) access control system block wiring diagrams.
c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

D. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.

2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

F. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

G. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

H. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:

1. Ten years for mortise locks and latches.
2. Ten years for manual surface door closer bodies.
3. Two years for electromechanical door hardware.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

a. Two Hinges: For doors with heights up to 60 inches.
b. Three Hinges: For doors with heights 61 to 90 inches.
c. Four Hinges: For doors with heights 91 to 120 inches.
d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:

a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

5. Manufacturers:

a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).

B. Pin and Barrel Continuous Hinges: ANSI/BHMA A156.26 Grade 1-600 certified pin and barrel continuous hinges with minimum 14 gauge Type 304 stainless steel hinge leaves, concealed teflon coated stainless pin, and twin self lubricated nylon bearings at each knuckle separation. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:

a. Markar Products; ASSA ABLOY Architectural Door Accessories (MR).
b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).
c. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

2.3 POWER TRANSFER DEVICES

A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - QC (# wires) Option.

B. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

a. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE) – EL-CEPT Series.
b. Securitron (SU) - EL-CEPT Series.

C. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified

hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:
    a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Electrical Connecting Kit: QC-R001.
    b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

    a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) – QC-C Series.

2.4 DOOR OPERATING TRIM

A. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.

5. Manufacturers:

    a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

2.5 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

1. Manufacturers:

B. Cylinders: Original manufacturer cylinders complying with the following:

1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored-Lock Type: Cylinders with tailpieces to suit locks.

4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
5. Keyway: Match Facility Standard.

C. Keying System: Each type of lock and cylinders to be factory keyed.

1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. Existing System: Key locks to Owner's existing system.
4. New System: Key locks to a new key system as directed by the Owner.

D. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).

E. Construction Keying: Provide construction master keyed cylinders.

F. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

G. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Manufacturers:

a. Lund Equipment (LU).
b. MMF Industries (MM).
c. Telkee (TK).

H. Key Control Software: Provide one network version of "Key Wizard" branded key management software package that includes one year of technical support and upgrades to software at no charge. Provide factory key system formatted for importing into “Key Wizard” software.

2.6 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

1. Manufacturers:

a. Sargent Manufacturing (SA) – 8200 Series.

2.7 ELECTROMECHANICAL LOCKING DEVICES

A. Electromechanical Mortise Locksets, Grade 1 (Heavy Duty): Subject to same compliance standards and requirements as mechanical mortise locksets, electrified locksets to be of type and design as specified below.

1. Electrified Lock Options: Where indicated in the Hardware Sets, provide electrified options including: outside door lock/unlock trim control, latchbolt and lock/unlock status monitoring, deadbolt monitoring, and request-to-exit signaling. Support end-of-line resistors contained within the lock case. Unless otherwise indicated, provide electrified locksets standard as fail secure.

2. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.

3. Manufacturers:

a. Sargent Manufacturing (SA) - 8200 Series.

2.8 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.9 ELECTRIC STRIKES

A. Standard Electric Strikes: Heavy duty, cylindrical and mortise lock electric strikes conforming to ANSI/BHMA A156.31, Grade 1, UL listed for both Burglary Resistance and for use on fire

rated door assemblies. Stainless steel construction with dual interlocking plunger design tested to exceed 3000 lbs. of static strength and 350 ft-lbs. of dynamic strength. Strikes tested for a minimum 1 million operating cycles. Provide strikes with 12 or 24 VDC capability and supplied standard as fail-secure unless otherwise specified. Provide latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike where specified.

1. Manufacturers:

    a. HES (HS).

B. Surface Mounted Rim Electric Strikes: Surface mounted rim exit device electric strikes conforming to ANSI/BHMA A156.31, Grade 1, and UL Listed for both Burglary Resistance and for use on fire rated door assemblies. Construction includes internally mounted solenoid with two heavy-duty, stainless steel locking mechanisms operating independently to provide tamper resistance. Strikes tested for a minimum of 500,000 operating cycles. Provide strikes with 12 or 24 VDC capability supplied standard as fail-secure unless otherwise specified. Option available for latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike. Strike requires no cutting to the jamb prior to installation.

1. Manufacturers:

    a. HES (HS) - 9500/9600 Series.

C. Provide electric strikes with in-line power controller and surge suppressor by the same manufacturer as the strike with the combined products having a five year warranty.

2.10 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.

2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.

3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.

4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.

5. Flush End Caps: Provide flush end caps made of architectural metal in the same finish as the devices as in the Hardware Sets. Plastic end caps will not be acceptable.

6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.

    a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
    b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.

8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.

9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

10. Rail Sizing: Provide exit device rails factory sized for proper door width application.

11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.

1. Manufacturers:

    a. Sargent Manufacturing (SA) - 80 Series.

C. Tube Steel Removable Mullions: ANSI/BHMA A156.3 removable steel mullions with malleable-iron top and bottom retainers and a primed paint finish.

1. Provide keyed removable feature where specified in the Hardware Sets.

2. Provide stabilizers and mounting brackets as required.

3. Provide electrical quick connection wiring options as specified in the hardware sets.

4. Manufacturers:

    a. Sargent Manufacturing (SA) - 980S Series.

2.11 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.

2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.

3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.

4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.

5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Manufacturers:

a. Sargent Manufacturing (SA) - 351 Series.

2.12 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.

4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:

    a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

6. Manufacturers:

    a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

2.13 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

    a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:

    a. Rixson Door Controls (RF).
    b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    c. Sargent Manufacturing (SA).

2.14 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

2.15 ELECTRONIC ACCESSORIES

A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Manufacturers:

a. Securitron (SU) - DPS Series.

B. Power Supplies: Provide Nationally Recognized Testing Laboratory Listed 12VDC or 24VDC (field selectable) filtered and regulated power supplies. Include battery backup option with integral battery charging capability in addition to operating the DC load in event of line voltage failure. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.

1. Manufacturers:

    a. Securitron (SU) - BPS Series.

2.16 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.17 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. The supplier is responsible for handing and sizing all products and providing the correct option for the appropriate door type and material where more than one is presented in the hardware sets. Quantities listed are for each pair of doors, or for each single door.

C. Manufacturer’s Abbreviations:

1. MK - McKinney
2. ST - Stanley Works
3. ST - dormakaba Door Closers
4. ST - dormakaba Hinges
5. MR - Markar
6. SA - Sargent
7. AD - Adams Rite
8. AA - ASSA High Security Locks
9. HS - HES
10. RO - Rockwood
11. RF - Rixson
12. NO - Norton

13. PE - Pemko
14. SU - Securitron

Hardware Sets

Set: 1.0

Doors: 001, 009, 010, 011
Description: Exterior Alum Pair - Panic - CR

2	Continuous Hinge	FM300 WEP	630	MR	
1	Removable Mullion	L980A	US28	SA	
1	Exit Device (exit only)	5CH LC 16 43 8810 x 525 edge guard on touch pad	US32D	SA	
1	Exit Device (nightlatch)	5CH LC 16 43 8804 x 525 edge guard on touch pad	US32D	SA	
4	Cylinder as req'd	to match existing facility std		AA	
2	Electric Strike	9500	630	HS	⚡
1	Vandal Resistant Trim	VRT24	US32D	RO	
1	Vandal Resistant Trim	VRT24 C	US32D	RO	
2	Concealed Overhead Stop	1-X36(as req'd in lieu of wall / floor stop)	630	RF	
2	Door Closer	351 P10	EN	SA	
1	Threshold	Per Sill Detail		PE	
1	Rain Guard	346C (omit @ overhang)		PE	
2	Sweep	18062CNB		PE	
2	Position Switch	DPS		SU	⚡
1	Power Supply	BPS-24		SU	⚡

Notes: Card Reader, wiring and electrical interface by Security Contractor
Weatherstripping by Aluminum Door Supplier

Set: 1.1

Doors: 001, 003, 009,
Description: Exterior Alum Pair – Auto Operator - Panic - CR

2	Continuous Hinge	FM300 WEP	630	MR
1	Removable Mullion	L980A	US28	SA
1	Exit Device (exit only)	5CH LC 16 43 8810 x 525 edge guard on touch pad	US32D	SA

1	Exit Device (nightlatch)	5CH LC 16 43 8804 x 525 edge guard on touch pad	US32D	SA
5	Cylinder as req'd	to match existing facility std		AA
2	Electric Strike	9500	630	HS
1	Vandal Resistant Trim	VRT24	US32D	RO
1	Vandal Resistant Trim	VRT24 C	US32D	RO
2	Auto Operator	Besam SW200i – Reference Spec section 087113	EN	SA
2	Activation Full Length Switch	Wikk Ingressor	630	
1	Mortise Key Switch	MKA2		SU
1	Threshold	Per Sill Detail		PE
1	Rain Guard	346C (omit @ overhang)		PE
2	Sweep	18062CNB		PE
2	Position Switch	DPS		SU

Notes: Card Reader, wiring and electrical interface by Security Contractor
Weatherstripping by Aluminum Door Supplier

Set: 2.0

Doors: 002
Description: Exterior Sgl - Panic - CR

1	Continuous Hinge	FM300 WEP	630	MR
1	Exit Device (nightlatch)	5CH LC 16 43 8804 x 525 edge guard on touch pad	US32D	SA
2	Cylinder as req'd	to match existing facility std		AA
1	Electric Strike	9500	630	HS
1	Vandal Resistant Trim	VRT24 C	US32D	RO
1	Door Closer	351 P10	EN	SA
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO
1	Door Stop	466	Black	RO
1	Threshold	Per Sill Detail		PE
1	Rain Guard	346C (omit @ overhang)		PE
1	Gasketing	2891APK		PE
1	Sweep	18062CNB		PE
1	Position Switch	DPS		SU
1	Power Supply	BPS-24		SU

Notes: Card Reader, wiring and electrical interface by Security Contractor
Operational Narrative: Door normally closed and locked. Upon presentation of valid credential, door will

momentarily unlock. Free egress at all times. In the event of activation of the Fire alarm or loss of power, doors will remain closed and locked.

Set: 3.0

Doors: 004, 008
Description: Exterior Sgl - Panic

1	Continuous Hinge	FM300 WEP	630	MR	
1	Exit Device (nightlatch)	5CH LC 16 43 8804 x 525 edge guard on touch pad	US32D	SA	
2	Cylinder as req'd	to match existing facility std		AA	
1	Vandal Resistant Trim	VRT24 C	US32D	RO	
1	Concealed Overhead Stop	1-X36(as req'd in lieu of wall / floor stop)	630	RF	
1	Door Closer	351 P10	EN	SA	
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO	
1	Threshold	Per Sill Detail		PE	
1	Rain Guard	346C (omit @ overhang)		PE	
1	Gasketing	2891APK		PE	
1	Sweep	18062CNB		PE	

Set: 4.0

Doors: 005
Description: Exterior Sgl - CR

1	Continuous Hinge	FM300 CTP WEP	630	MR	
1	Fail Secure Electric Lock	LC RX 8271-24V LNP	US26D	SA	⚡
1	Cylinder as req'd	to match existing facility std		AA	
1	Door Closer	351 P10	EN	SA	
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO	
1	Door Stop	466	Black	RO	
1	Threshold	Per Sill Detail		PE	
1	Rain Guard	346C (omit @ overhang)		PE	
1	Gasketing	2891APK		PE	
1	Sweep	18062CNB		PE	
1	Electric Power Transfer	CEPT-10		SU	⚡
1	ElectroLynx Harness	QC-C1500P		MK	⚡
1	ElectroLynx Harness	QC-C400P		MK	⚡
1	Position Switch	DPS		SU	⚡

1	Power Supply	BPS-24		SU

Notes: Card reader, wiring and electrical interface by Security Contractor

Set: 5.0

Doors: 006
Description: Exterior Pair - Panic - CR - STC

2	Continuous Hinge	FM300 WEP	630	MR
1	Removable Mullion	L980S	PC	SA
1	Exit Device (exit only)	5CH LC 16 43 8810 x 525 edge guard on touch pad	US32D	SA
1	Exit Device (nightlatch)	5CH LC 16 43 8804 x 525 edge guard on touch pad	US32D	SA
4	Cylinder as req'd	to match existing facility std		AA
2	Electric Strike	9500	630	HS
2	Door Closer	351 CPS	EN	SA
2	Kick Plate	K1050 10" 4BE CSK	US32D	RO
2	Position Switch	DPS		SU
1	Power Supply	BPS-24		SU

Notes: Card reader, wiring and electrical interface by Security Contractor
Acoustical door seals including seals, door bottom and threshold by Door Manufacturer

Set: 6.0

Doors: 007
Description: Exterior Sgl - STC

1	Continuous Hinge	FM300 WEP	630	MR
1	Storeroom Lock	LC 8204 LNP	US26D	SA
1	Cylinder as req'd	to match existing facility std		AA
1	Door Closer	351 P10	EN	SA
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO
1	Door Stop	466	Black	RO

Notes: Acoustical Seals, including seals, door bottom and threshold by Door Maunfacturer

Set: 7.0

Doors: 120A, 120B, 125, 126A, 126B, 127A, 127B, 128A, 128B, 129A, 129B, 130, 220A, 220B, 221A, 221B, 222A, 222B, 223A, 223B, 224A, 224B, 225A, 225B, 226A, 226B

Description: Interior Sgl - Panic - CR

3	Hinge (heavy weight)	T4A3786 (NRP)	US26D	MK	
1	Exit Device (nightlatch)	5CH LC 16 43 8804 x 525 edge guard on touch pad	US32D	SA	
1	Cylinder as req'd	to match existing facility std		AA	
1	Electric Strike	9500	630	HS	⚡
1	Concealed Overhead Stop	1-X36(as req'd in lieu of wall / floor stop)	630	RF	
1	Door Closer	351 P10	EN	SA	
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO	
1	Wall Stop	403	US26D	RO	
3	Silencer	608		RO	
1	Position Switch	DPS		SU	⚡
1	Power Supply	BPS-24		SU	⚡

Set: 8.0

Doors: 121
Description: Interior Sgl - Panic - CR - STC

3	Hinge (heavy weight)	T4A3786 (NRP)	US26D	MK	
1	Exit Device (nightlatch)	5CH LC 16 43 8804 x 525 edge guard on touch pad	US32D	SA	
2	Cylinder as req'd	to match existing facility std		AA	
1	Electric Strike	9500	630	HS	⚡
1	Concealed Overhead Stop	1-X36(as req'd in lieu of wall / floor stop)	630	RF	
1	Door Closer	351 P10	EN	SA	
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO	
1	Position Switch	DPS		SU	⚡
1	Power Supply	BPS-24		SU	⚡

Notes: Acoustical Seals, including seals, door bottom and threshold by Door Manufacturer
Card Reader, wiring and electrical interface by Security Contractor
Operational Narrative: Door normally closed and locked. Upon presentation of valid credential, door will momentarily unlock. Free egress at all times. In the event of activation of the Fire alarm or loss of power, doors will remain closed and locked.

Set: 9.0

Doors: 107, 108, 123, 124, 126, 131, 140, 145A, 145B, 201, 207, 208, 209, 230, 233

Description: Interior Sgl - CR

3	Hinge (heavy weight)	T4A3786 (NRP) QCW	US26D	MK
1	Fail Secure Electric Lock	LC RX 8271-24V LNP	US26D	SA
1	Cylinder as req'd	to match existing facility std		AA
1	Concealed Overhead Stop	1-X36(as req'd in lieu of wall / floor stop)	630	RF
1	Door Closer	351 O/P9	EN	SA
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO
1	Wall Stop	403	US26D	RO
3	Silencer	608		RO
1	ElectroLynx Harness	QC-C1500P		MK
1	ElectroLynx Harness	QC-C400P		MK
1	Position Switch	DPS		SU
1	Power Supply	BPS-24		SU

Notes: Card Reader, wiring and electrical interface by Security Contractor
Operational Narrative: Door normally closed and locked. Upon presentation of valid credential, door will momentarily unlock. Free egress at all times. In the event of activation of the Fire alarm or loss of power, doors will remain closed and locked.

Set: 10.0

Doors: 104, 205
Description: Interior Sgl - CR

3	Hinge (heavy weight)	T4A3786 (NRP) QCW	US26D	MK
1	Fail Secure Electric Lock	LC RX 8271-24V LNP	US26D	SA
1	Cylinder as req'd	to match existing facility std		AA
1	Concealed Overhead Stop	1-X36(as req'd in lieu of wall / floor stop)	630	RF
1	Door Closer	351 O/P9	EN	SA
1	Mop Plate	K1050 6" high 4BE CSK	US32D	RO
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO
1	Wall Stop	403	US26D	RO
3	Silencer	608		RO
1	ElectroLynx Harness	QC-C1500P		MK
1	ElectroLynx Harness	QC-C400P		MK
1	Position Switch	DPS		SU

1	Power Supply	BPS-24		SU

Notes: Card Reader, wiring and electrical interface by Security Contractor
Operational Narrative: Door normally closed and locked. Upon presentation of valid credential, door will momentarily unlock. Free egress at all times. In the event of activation of the Fire alarm or loss of power, doors will remain closed and locked.

Set: 11.0

Doors: 122
Description: Interior Sgl - CR - STC

3	Hinge (heavy weight)	T4A3786 (NRP) QCW	US26D	MK
1	Fail Secure Electric Lock	LC RX 8271-24V LNP	US26D	SA
1	Cylinder as req'd	to match existing facility std		AA
1	Concealed Overhead Stop	1-X36(as req'd in lieu of wall / floor stop)	630	RF
1	Door Closer	351 O/P9	EN	SA
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO
1	Wall Stop	403	US26D	RO
1	ElectroLynx Harness	QC-C1500P		MK
1	ElectroLynx Harness	QC-C400P		MK
1	Position Switch	DPS		SU
1	Power Supply	BPS-24		SU

Notes: Acoustical Seals - including seals, door bottom and threshold by Door Manufacturer
Card Reader, wiring and electrical interface by Security Contractor
Operational Narrative: Door normally closed and locked. Upon presentation of valid credential, door will momentarily unlock. Free egress at all times. In the event of activation of the Fire alarm or loss of power, doors will remain closed and locked.

Set: 12.0

Doors: 111, 112, 211, 212
Description: Interior Sgl Multi-Occup toilet

3	Hinge (heavy weight)	T4A3786 (NRP)	US26D	MK
1	Passage Set	8215 LNP	US26D	SA
1	Concealed Overhead Stop	1-X36(as req'd in lieu of wall / floor stop)	630	RF
1	Door Closer	351 O/P9	EN	SA

1	Kick Plate	K1050 10" 4BE CSK	US32D	RO
1	Wall Stop	403	US26D	RO
3	Silencer	608		RO

Set: 13.0

Doors: 113
Description: Interior Sgl Janitor

3	Hinge (heavy weight)	T4A3786 (NRP)	US26D	MK
1	Storeroom Lock	LC 8204 LNP	US26D	SA
2	Cylinder as req'd	to match existing facility std		AA
1	Door Closer	351 CPS	EN	SA
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO
3	Silencer	608		RO

Set: 14.0

Doors: 143, 144
Description: Interior Sgl Office

3	Hinge (heavy weight)	T4A3786 (NRP)	US26D	MK
1	Office Lock	LC 8205 LNP	US26D	SA
1	Cylinder as req'd	to match existing facility std		AA
1	Wall Stop	403	US26D	RO
3	Silencer	608		RO

Set: 15.0

Doors: 142, 231, 232, 234, 235, 236, 237, 238, 239
Description: Sliders

1	Sliders	By Mfr		00

Set: 16.0

Gates: G1, G2
Description: Gates

1	Lever lock	10G04 LP LC	626	SA
1	Cylinder as req'd	to match existing facility std		AA

Balance of hardware by Gate Manufacturer

Set: 17.0

Doors: Existing
Description: Threshold

1	Threshold	195A x 228A(rip to 7") x 196A	626	SA

END OF SECTION 087100

This page intentionally left blank.

SECTION 087113 - AUTOMATIC DOOR OPERATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Low energy automatic door operators for swinging doors.

B. Related Sections:

1. Division 08 Section “Door Schedule”.
2. Division 08 Section “Hollow Metal Doors and Frames”.
3. Division 08 Section “Flush Wood Doors”.
4. Division 08 Section “Aluminum-Framed Entrances and Storefronts”.
5. Division 08 Section “Door Hardware”.
6. Division 08 Section “Access Control Hardware”.
7. Division 26 Section “Electrical”.

A. Codes and Standards: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ANSI/BHMA A156.4 - Door Controls, Door Closers.
3. ANSI/BHMA A156.19 - Power Assist and Low-Energy Power Operated Doors.
4. ICC/IBC - International Building Code.
5. NFPA 70 - National Electrical Code.
6. NFPA 80 - Fire Doors and Windows.
7. NFPA 101 - Life Safety Code.
8. NFPA 105 - Installation of Smoke Door Assemblies.
9. UL/ULC and CSA C22.2 – Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
10. UL 325 - Door, Drapery, Gate, Louver, and Window Operators and Systems.
11. State Building Codes, Local Amendments.

1.3 PERFORMANCE REQUIREMENTS

A. Automatic door operators to be used on interior or exterior doors; up to 200 pounds (91 kg) weight and maximum door width of 48" (1219 mm).

1. Auto door operator capable of operating within temperature ranges of -22°F (-30°C) and 122°F (50°C).

1.4 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, and finishes for automatic door operators, including activation devices. Include operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: Include details and attachments to other work.

1. Include locations and elevations of each unique entrance showing activation devices.
2. Indicate required clearances, components, and location and size of field connections.
3. Wiring Diagrams: For power, signal, and activation wiring.

C. Qualification Data: Provide copy of manufacturer's official certification or accreditation document indicating proof of status as a qualified and authorized installer of automatic door operators and accessories.

D. Operating and Maintenance Manuals: Provide manufacturer's operating and maintenance manual for each item comprising the automatic door operator installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturer and Installer providing the operators and installation. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.

E. Warranties and Maintenance: Special warranties and maintenance agreements specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project.

B. Certified Installer Qualifications: Locally certified ASSA ABLOY Power Operator Preferred Installer required for the installation and maintenance of the automatic door operator units and accessories indicated for the Project.

C. Source Limitations: Obtain automatic door operators, including activation devices, from single source, qualified supplier unless otherwise indicated.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended location and application.

E. Exit Door Requirements: Comply with requirements of authorities having jurisdiction for doors with automatic door operators serving as a component of a required means of egress.

F. Fire Rated Door Assemblies: Provide operators for fire rated door assemblies that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for use on types and sizes of labeled fire doors required.

G. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and the procedures for receiving, handling, and installing automatic door operators.

1. Prior to installation of automatic door operators, arrange for certified Installer's representative to conduct a project specific meeting to review the installation and maintenance of their respective products. Project meeting to be attended by representatives of related trades furnishing and installing the aluminum, hollow metal and wood doors sections.
2. Review and finalize construction schedule and verify availability of materials.

1.6 COORDINATION

A. Electrical Systems Coordination: Coordinate the layout and installation of scheduled automatic door operators and related activation devices, with required connections to source power junction boxes, remote power supplies, access control equipment, detection and monitoring hardware, and fire alarm system.

B. Templates: Obtain and distribute to the parties involved, templates for doors, frames, operators, and other work specified to be factory prepared and reinforced for installing automatic door operators. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing automatic door operators to comply with indicated requirements.

C. Door and Frame Preparation: Related Division 08 Sections (Steel, Aluminum and Wood) doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified automatic door operators without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Written warranty, executed by manufacturer, agreeing to repair or replace components of automatic door operators that fail in materials or workmanship within specified warranty period after final acceptance by Owner. Failures include, but are not limited to, the following:

1. Faulty or sporadic operation of automatic door operator, including activation and safety devices.
2. Deterioration of metals, metal finishes, and other materials beyond normal weathering or use.

C. Special Warranty Period: Two years from date of Substantial Completion.

D. Provide extended warranty from defects in material or workmanship under normal use for a period of 3 years from the date of substantial completion for units installed by a certified ASSA ABLOY Power Operator Preferred Installer in accordance with the manufacturer's written warranty certificate.

1.8 MAINTENANCE SERVICE

A. Maintenance Service: Beginning at Substantial Completion, and running concurrent with the specified warranty period, provide continuous (6) months full maintenance by skilled employees of automatic door operator Installer. Include planned and preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door operation. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.

B. Extended Maintenance Support and Service Agreement: Submit for Owner’s consideration an optional extended Service Agreement for the installed automatic door operator system. The extended Service Agreement is considered elective and is without manufacturer's requirement stipulating mandatory coverage for owner and/or vendor system support.

1. A published copy of this agreement to be included with the submittal package
2. Support for the installed automatic door operator system is provided through the vendor under a specified, limited 24 hour support program.
3. Automatic door operators and components are to be available on a one-day turn around time frame from the vendor.

PART 2 - PRODUCTS

2.1 ELECTROMECHANICAL DOOR OPERATORS

A. General: Provide low energy operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for compliance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation devices.

1. Fire-Rated Doors: Provide door operators for fire-rated door assemblies that comply with NFPA 80 for fire-rated door components and are listed and labeled by a qualified testing agency.

B. Standard: Certified ANSI/BHMA A156.19.

C. Performance Requirements:

1. Opening Force if Power Fails: Not more than 15 lbf required to release a latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door.
2. Entrapment Protection: Not more than 15 lbf required to prevent stopped door from closing or opening.

D. Configuration: Surface mounted or in-ground as required. Door operators to control single swinging and pair of swinging doors.

E. Operation: Power opening and spring closing operation capable of meeting ANSI A117.1 accessibility guideline. Provide time delay for door to remain open before initiating closing cycle as required by ANSI/BHMA A156.19.

F. Features: Operator units to have full feature adjustments for door opening and closing force and speed, backcheck, motor assist acceleration from 0 to 30 seconds, time delay, vestibule interface delay, obstruction recycle, and hold open time from 0 up to 30 seconds.
   1. Battery Back Up system to allow for continued operation after power fails

G. Provide outputs and relays on board the operator to allow for coordination of exit device latch retraction, electric strikes, magnetic locks, card readers, safety and motion sensors and specified auxiliary contacts.

H. Brackets and Reinforcements: Manufacturer's standard, fabricated from aluminum with nonferrous shims for aligning system components.

I. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   1. Besam Automated Entrance Systems (BE) – SW200i Series.

2.2 ACTIVATION DEVICES

A. General: Provide activation devices in accordance with ANSI/BHMA A156.19 standard, for condition of exposure indicated and for long term, maintenance free operation under normal traffic load operation. Coordinate activation control with electrified hardware and access control interfaces. Activation switches are standard SPST, with optional DPDT availability.

B. Push-Plate Switch: Momentary contact door control switch with push-plate actuator.

   1. Configuration: Square or round push-plate control switch with single or double gang junction box mounting. Provide narrow profile face plate where indicated for jamb or mullion mounting.

      a. Mounting Location: As indicated on Drawings.

   2. Push-Plate Material: Stainless steel.
   3. Message: International symbol of accessibility with "Push (Press) to Open (Operate)" text.
   4. Manufacturers:

      a. Wikk Industries (WI) – 36” Full Length Series.

2.3 ACCESSORIES

A. Signage: As required by cited ANSI/BHMA A156.19 standard for the type of operator.

2.4 FINISHES

A. Standard: Designations used to indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware. Units will be sprayed with a combination of waterborne acrylic and polyester powder coat.

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, door and frame preparation and reinforcements, power connections, electrical systems interfaces, and other conditions affecting performance of automatic door operators.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 INSTALLATION

A. General: Install complete automatic door operators according to manufacturer's written instructions and ANSI/BHMA A156;19 standard, including activation devices, control wiring, remote power units if any, connection to the building's fire alarm system, and required signage.

B. Power Connection: Reference Division 26 "Electrical" Sections for connection to electrical power distribution system.

C. Access Control System: Coordinate connections and operation with access control system

D. Signage: Apply signage as required by ANSI/BHMA A156.19 standard for type of door operator and direction of pedestrian travel.

3.3 FIELD QUALITY CONTROL

A. Inspection: Certified Installer' representative to inspect and test automatic door operators to determine compliance of installed systems with specifications and ANSI/BHMA A146.19 standard. Report discrepancies in writing to Architect and Contractor within 24 hours after inspection.

3.4 ADJUSTING

A. Comply with requirements of ANSI/BHMA A156.19 standard. Adjust automatic door operators to function smoothly, and lubricate as recommended by manufacturer.

3.5 DEMONSTRATION

A. Certified Installer's representative to provide eight (8) hours of training to Owner's maintenance personnel in the proper adjustment, operation, and maintenance of automatic door operators.

END OF SECTION 087113

This page intentionally left blank.

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Glass for windows, doors, interior borrowed lites, glazed entrance doors, storefront framing, glazed curtain walls, sloped glazing, and skylights.
2. Glazing sealants and accessories.

B. Related Requirements:

1. Section 088300 "Mirrors."
2. Section 088813 "Fire-Resistant Glazing."

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C1036.

C. Interspace: Space between lites of an insulating-glass unit.

1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review temporary protection requirements for glazing during and after installation.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches (300 mm) square.

C. Glazing Accessory Samples: For gaskets, sealants, and colored spacers, in 12-inch (300-mm) lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

E. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturers of insulating-glass units with sputter-coated, low-E coatings.

B. Product Certificates: For glass.

C. Product Test Reports: For tinted glass, coated glass, insulating glass, and glazing sealants, for tests performed by a qualified testing agency.

1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 12 month period.

D. Preconstruction adhesion and compatibility test report.

E. Sample Warranties: For special warranties.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.

B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

E. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Install glazing in mockups specified in Section 084113 "Aluminum-Framed Entrances and Storefronts" and Section 084413 "Glazed Aluminum Curtain Walls" to match glazing systems required for Project, including glazing methods.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.

1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
2. Use ASTM C1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.11 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F (4.4 deg C).

1.12 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in Schedules or comparable product by one of the following:

1. AGC Glass Company North America, Inc.
2. Cardinal Glass Industries.
3. Cristacurva.
4. Dlubak Corporation.
5. Gardner Glass, Inc.
6. GGI; General Glass International.
7. Glasswerks LA, Inc.
8. GTI; Glaz-Tech Industries.
9. Guardian Glass; SunGuard.
10. Hartung Glass Industries.
11. JE Berkowitz, LP.
12. Northwestern Industries, Inc.
13. Oldcastle BuildingEnvelope™.
14. Pilkington North America.
15. Schott North America, Inc.
16. Tecnoglass.
17. Trulite Glass & Aluminum Solutions, LLC.
18. Vetrotech Saint-Gobain.
19. Viracon, Inc.
20. Vitro Architectural Glass.

B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.

1. Obtain tinted glass from single source from single manufacturer.

2. Obtain Low-E-coated glass from single source from single manufacturer.
3. Obtain insulated glass from single source from single manufacturer.

C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.

C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the CBC and ASTM E1300.

1. Design Wind Pressures: As indicated on Drawings.
2. Probability of Breakage for Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass for a probability of breakage not greater than 0.001.
3. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch (25 mm), whichever is less.
4. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6 mm thick unless otherwise indicated.
2. For laminated-glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 REGULATORY REQUIREMENTS

A. General Requirements for Glass:

1. Glass Supports: Where one or more sides of any pane of glass are not firmly supported, or are subjected to unusual load conditions, detailed construction documents, detailed shop drawings, and analysis or test data ensuring safe performance for the specific installation shall be prepared by a registered design professional per CBC Section 2403.2.

    a. Additional Requirements: In addition to the requirements of CBC Section 2403.2, glass supports shall comply with the following per CBC Section 2403.2.1.

        1) The construction documents and analysis or test data required per CBC Section 2403.2 shall be submitted to the enforcement agency for approval.
        2) Glass firmly supported on all four edges shall be glazed with minimum laps and edge clearances set forth in CBC Table 23403.2.1.

2.4 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Regional Materials: Glazing shall be manufactured within 500 miles (800 km) of Project site.

C. Finish Material Pollutant Control: Finish materials shall comply with CGBC Sections 5.504.4.1 through 5.504.4.6 per CGBC Section 5.504.4.

1. Adhesives, Sealants, and Caulks: Adhesives, sealants, and caulks used on the project shall meet the requirements of the following standards per CGBC Section 5.504.4.1:

    a. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in CBC Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products specified in subparagraph below.
    b. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

2. Sealants and sealant primers shall comply with maximum VOC limits listed in CGBC Table 5.504.4.2.

D. VOC Content: Sealants and sealant primers shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Architectural Sealants: 250 g/L.
2. Architectural Sealant Primers for Nonporous Substrates: 250 g/L.
3. Architectural Sealant Primers for Porous Substrates: 775 g/L.

E. Low-Emitting Materials: Sealants and sealant primers shall comply with the requirements of authorities having jurisdiction.

2.5 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.

1. Minimum Glass Thickness for Exterior Lites: 6 mm.
2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

E. Strength:

1. Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article.
2. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article.
3. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.6 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.

B. Tinted Annealed Float Glass: ASTM C1036, Type I, Class 2 (tinted), Quality-Q3.

C. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

D. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

E. Back Painted Spandrel Glass: ASTM C1048, Type I, Condition C, Quality-Q3.

2.7 LAMINATED GLASS

A. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.

2.8 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Perimeter Spacer Basis-of-Design Product: Glasswerks G3 Super Spacer. Construction complying with the following requirements:

    a. Spacer Material: G3 Tri-Seal Super Spacer.
    b. Color: Black unless otherwise indicated.
    c. Corner Construction: Manufacturer's standard corner construction.

        1) Thermoset structural silicone containing no-metal with integral 3A desiccant molecular sieve not less than 47 percent by weight.

    d. PIB primary seal.
    e. Silicone, Polyurethane, Polysulfide, DSE/DSA’s, or Hot Melt secondary seal.
    f. Pressure-sensitive acrylic adhesive.
    g. Pre-applied advanced multi-layer vapor barrier.

3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.9 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 100/50, Use NT.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Dow Corning Corporation.
b. GE Construction Sealants; Momentive Performance Materials Inc.
c. Sika Corporation.
d. Tremco Incorporated.

2.10 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

2.11 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks:

1. EPDM, silicone, neoprene, or santoprene with a Shore A durometer hardness of 85, plus or minus 5.
2. Type recommended by sealant or glass manufacturer.

D. Spacers:

1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
2. Type recommended by sealant or glass manufacturer.

E. Edge Blocks:

1. EPDM, silicone, neoprene, or santoprene with a Shore A durometer hardness per manufacturer's written instructions.
2. Type recommended by sealant or glass manufacturer.

F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.12 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

B. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide not less than 1/8 inch (3 mm) bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant where indicated and where recommended by manufacturer.

G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape where indicated and where recommended by manufacturer.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.7 MONOLITHIC GLASS SCHEDULE

A. Clear, fully tempered, float glass.

1. Minimum Thickness: 6 mm.
2. Safety glazing required.

3.8 LAMINATED GLASS SCHEDULE

A. Clear laminated glass with two plies of fully tempered float glass.

1. Minimum Thickness of Each Glass Ply: 6 mm.
2. Interlayer Thickness: 0.030 inch (0.76 mm).
3. Safety glazing required.

B. Obscure, clear laminated glass with two plies of fully tempered float glass.

1. Minimum Thickness of Each Glass Ply: 6 mm.

    a. Obscure (frosted) second or third surface.

2. Interlayer Thickness: 0.030 inch (0.76 mm).
3. Safety glazing required.

3.9 INSULATING GLASS SCHEDULE

A. Low-E-coated, tinted, insulating glass.

1. Overall Unit Thickness: 1 inch (25 mm).
2. Minimum Thickness of Each Glass Lite: 6 mm.
3. Outdoor Lite: Tinted, fully tempered, Low-E-coated, float glass.

    a. Basis-of-Design Product: PPG Industries, Inc.; Solarban 70XL Solargray Solar Control Low-E Glass.
    b. Tint Color: Gray.
    c. Low-E Coating: Pyrolytic or sputtered on second surface.

4. Interspace Content: Air.
5. Indoor Lite: Clear fully tempered, float glass.
6. Visible Light Transmittance: 34 percent minimum.
7. Visible Light Reflectance Exterior: 6.0 percent maximum.
8. Visible Light Reflectance Interior: 12.0 percent maximum.
9. Winter Nighttime U-Factor (U-value): 0.28 maximum.
10. Solar Heat Gain Coefficient: 0.20 maximum.
11. Light to Solar Gain Ratio: 1.70 minimum.
12. Safety glazing required.

B. Low-E-coated, tinted, insulating back painted spandrel glass.

1. Overall Unit Thickness: 1 inch (25 mm).
2. Minimum Thickness of Each Glass Lite: 6 mm.
3. Outdoor Lite: Tinted, fully tempered, Low-E-coated, float glass.

    a. Basis-of-Design Product: PPG Industries, Inc.; Solarban 70XL Solargray Solar Control Low-E Glass.
    b. Tint Color: Gray.
    c. Low-E Coating: Pyrolytic or sputtered on second surface.

4. Interspace Content: Air.
5. Indoor Lite: Clear, fully tempered, back painted, float glass.

    a. Basis-of-Design Product: GlasPro; GlasPro-BP, Back Painted Glass.
    b. Coating Color: On The Rocks.
    c. Opaque Coating Location: Third surface.

6. Safety glazing required.

END OF SECTION 088000

SECTION 092116.23 - GYPSUM BOARD SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes gypsum board shaft wall assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: For each component of gypsum board shaft wall assembly.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For shaft wall assemblies and firestop tracks, from ICC-ES.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and support them on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

A. Environmental Limitations:

1. Comply with gypsum-shaftliner-board manufacturer's written instructions.
2. Comply with ASTM C 840 requirements or with gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

1. Gypsum panels installed in areas that are not enclosed and conditioned shall have fiberglass mat laminated to both sides and manufacturer's 12 month exposure warranty.

C. Do not install panels that are wet, moisture damaged, or mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: Provide materials and construction identical to those of assemblies tested according to ASTM E 90 and classified according to ASTM E 413 by a testing and inspecting agency.

1. STC Rating: Not less than 51 unless otherwise indicated.

2.2 REGULATORY REQUIREMENTS

A. All insulation provided for use on this project shall be identified as required by Section 12-13-1557 of the California Referenced Standards Code (Part 12, Title 24, C.C.R.); Chapter 12-13 "Standards For Insulating Material", (See Part 6, Title 24, C.C.R.); Department Of Consumer Affairs, Bureau of Home Furnishings and Thermal Insulation; Article 3: "Standards for Insulating Material".

2.3 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Recycled Content of Steel Products: Recycled content not less than 20 percent.

C. Recycled Content of Gypsum Panel Products: Recycled content not less than 20 percent by weight.

D. Thermal Insulation, Tier 1: Comply with the following standards per CGBC Section A5.504.4.8:

1. Chapters 12-13 (Standards for Insulating Material) in Title 24, Part 12, the California Referenced Standards Code.
2. The VOC-emission limits defined in 2009 CHPS criteria and listed in its High Performance Products Database.
3. California Department of Public Health 2010 Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1, February 2010 (also known as Specification 01350).

E. Thermal Insulation, Tier 2: Thermal insulation, No-added Formaldehyde. Install thermal insulation which complies with Tier 1 plus does not contain any added formaldehyde per CGBC Section A5.504.4.8.1.

F. Provide glass-fiber blanket insulation as follows:

1. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05 ppm formaldehyde.
2. Recycled Content: Recycled content not less than 20 percent.

G. Provide mineral-wool blanket insulation as follows:

1. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05 ppm formaldehyde.
2. Recycled Content: Recycled content not less than 20 percent.

H. Regional Materials: Gypsum panel products shall be manufactured within 500 miles (800 km) of Project site.

I. Low-Emitting Materials: Gypsum shaft wall assemblies shall comply with the requirements of authorities having jurisdiction.

J. Interior Sound Transmission: Wall and floor-ceiling assemblies separating tenant spaces and tenant spaces and public spaces shall have an STC of at least 40 per CGBC Section 5.507.4.3.

2.4 GYPSUM BOARD SHAFT WALL ASSEMBLIES

A. Fire-Resistance Rating: As indicated on Drawings.

B. Gypsum Shaftliner Board:

1. Moisture- and Mold-Resistant Type X: ASTM C 1396/C 1396M; manufacturer's proprietary fire-resistive liner panels with ASTM D 3273 mold-resistance score of 10 as rated according to ASTM D 3274, 1 inch (25.4 mm) thick, and with double beveled long edges.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) American Gypsum.
2) CertainTeed Corporation.
3) Continental Building Products, LLC.
4) Georgia-Pacific Building Products.
5) National Gypsum Company.
6) PABCO Gypsum.
7) Temple-Inland Building Products by Georgia-Pacific.
8) United States Gypsum Company.

b. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

C. Non-Load-Bearing Steel Framing, General: Complying with ASTM C 645 requirements for metal unless otherwise indicated and complying with requirements for fire-resistance-rated assembly indicated.

1. Protective Coating: ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized unless otherwise indicated.

D. Studs: Manufacturer's standard profile for repetitive, corner, and end members, and fire-resistance-rated assembly indicated.

1. Depth: As indicated on Drawings.
2. Minimum Base-Metal Thickness: Not less than 0.0329 inch (0.836 mm) thick (20 gage nominal).

E. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but not less than 2 inches (51 mm) long and matching studs in depth.

1. Minimum Base-Metal Thickness: Not less than 0.0329 inch (0.836 mm) thick, (20 gage nominal).

F. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Blazeframe Industries.
b. CEMCO; California Expanded Metal Products Co.
c. Fire Trak Corp.
d. GCP Applied Technologies Inc. (formerly Grace Construction Products).
e. Metal-Lite.
f. Steel Network, Inc. (The).

2. Firestop Tracks: Provide firestop track at head of shaft wall on each floor level.

G. Elevator-Hoistway-Entrance Struts: Manufacturer's standard J-profile jamb strut with long-leg length of not less than 3 inches (76 mm), matching studs in depth, and not less than 0.0329 inch (0.836 mm) thick, (20 gage nominal), unless indicated otherwise.

H. Finish Panels: As indicated on Drawings.

1. Room-Side Finish: As indicated on Drawings.
2. Shaft-Side Finish: As indicated by fire-resistance-rated assembly design designation.

I. Gypsum Board: As specified in Section 092900 "Gypsum Board."

J. Cementitious Backer Units: As specified in Section 093013 "Ceramic Tiling."

K. Sound Attenuation Blankets: As specified in Section 092900 "Gypsum Board."

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with shaft wall manufacturer's written instructions.

B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes as specified in Section 092900 "Gypsum Board" that comply with gypsum board shaft wall assembly manufacturer's written instructions for application indicated.

C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.

D. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.

1. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488/E 488M conducted by a qualified testing agency.

E. Reinforcing: Galvanized-steel reinforcing strips with not less than 0.0329 inch (0.836 mm) thick, (20 gage nominal), base metal (uncoated).

F. Acoustical Sealant: Section 079219 "Acoustical Joint Sealants."

G. Gypsum Board Cants:

1. Gypsum Board Panels: As specified in Section 092900 "Gypsum Board," Type X, 5/8 inch (16 mm) panels.
2. Adhesive: Laminating adhesive as specified in Section 092900 "Gypsum Board."
3. Non-Load-Bearing Steel Framing: As specified in Section 092216 "Non-Structural Metal Framing."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Sprayed Fire-Resistive Materials: Coordinate with gypsum board shaft wall assemblies so both elements of Work remain complete and undamaged. Patch or replace sprayed fire-resistive materials removed or damaged during installation of shaft wall assemblies to comply with requirements specified in Section 078100 "Applied Fireproofing."

B. After sprayed fire-resistive materials are applied, remove only to extent necessary for installation of gypsum board shaft wall assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

3.3 INSTALLATION

A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated and manufacturer's written installation instructions.

1. Install panel products in largest pieces possible.

B. Do not bridge building expansion joints with shaft wall assemblies; frame both sides of expansion joints with furring and other support.

C. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, wall-mounted door stops, and similar items that cannot be supported directly by shaft wall assembly framing.

1. Elevator Hoistway: At elevator hoistway-entrance door frames, provide jamb struts on each side of door frame.
2. Reinforcing: Provide where items attach directly to shaft wall assembly as indicated on Drawings; accurately position and secure behind at least one layer of face panel.

D. Penetrations: At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons and floor indicators, and similar items.

E. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels while maintaining continuity of fire-rated construction.

F. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

G. Control Joints: Install control joints at locations indicated on Drawings or, if not indicated, according to ASTM C 840 and in specific locations approved by Architect while maintaining fire-resistance rating of gypsum board shaft wall assemblies.

H. Sound-Rated Shaft Wall Assemblies: Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly.

I. Gypsum Board Cants: At projections into shaft exceeding 4 inches (102 mm) and where indicated, install gypsum board cants covering tops of projections.

1. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at not more than 24 inches (610 mm) o.c. with screws fastened to shaft wall framing.
2. Where non-load-bearing steel framing is required to support gypsum board cants, install framing at not more than 24 inches (610 mm) o.c. and extend studs from the projection to shaft wall framing.

J. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

3.4 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, or mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092116.23

This page intentionally left blank.

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings and soffits.
3. Grid suspension systems for gypsum board ceilings.

B. Related Requirements:

1. Section 054000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; and roof rafters and ceiling joists.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of code-compliance certification for studs and tracks.

B. Evaluation Reports: For embossed, high-strength steel studs and tracks, firestop tracks, post-installed anchors, and grid suspension system for gypsum board ceilings, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association, or the Steel Stud Manufacturers Association.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Suspended ceilings and soffits shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.

C. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

1. STC Rating: Not less than 40 unless otherwise indicated.

2.2 REGULATORY REQUIREMENTS

A. All insulation provided for use on this project shall be identified as required by Section 12-13-1557 of the California Referenced Standards Code (Part 12, Title 24, C.C.R.); Chapter 12-13 "Standards For Insulating Material", (See Part 6, Title 24, C.C.R.); Department Of Consumer Affairs, Bureau of Home Furnishings and Thermal Insulation; Article 3: "Standards for Insulating Material".

B. Seismic Standard: Provide suspended ceilings and soffits designed and installed to withstand the effects of earthquake motions according to one of the following:

1. "Metal Suspension Systems For Lay-in Panel Ceilings: 2013 CBC": For grid suspension systems comply with State of California, Division of the State Architect, Interpretation of Regulations Document IR 25-2.13.
2. "Gypsum Board Ceiling Suspension Conventional Construction – One Layer": Comply with State of California, Division of the State Architect, Interpretation of Regulations Document IR 25-3.13.

2.3 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Recycled Content of Steel Products: Recycled content not less than 20 percent.

C. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

D. Thermal Insulation, Tier 1: Comply with the following standards per CGBC Section A5.504.4.8:

1. Chapters 12-13 (Standards for Insulating Material) in Title 24, Part 12, the California Referenced Standards Code.
2. The VOC-emission limits defined in 2009 CHPS criteria and listed in its High Performance Products Database.

3. California Department of Public Health 2010 Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1, February 2010 (also known as Specification 01350).

E. Thermal Insulation, Tier 2: Thermal insulation, No-added Formaldehyde. Install thermal insulation which complies with Tier 1 plus does not contain any added formaldehyde per CGBC Section A5.504.4.8.1.

F. Provide glass-fiber blanket insulation as follows:

1. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05 ppm formaldehyde.
2. Recycled Content: Recycled content not less than 20 percent.
3. Insulation shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
4. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 20 percent.

G. Provide mineral-wool blanket insulation as follows:

1. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05 ppm formaldehyde.
2. Recycled Content: Recycled content not less than 20 percent.
3. Insulation shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
4. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 20 percent.

H. Interior Sound Transmission: Wall and floor-ceiling assemblies separating tenant spaces and tenant spaces and public spaces shall have an STC of at least 40 per CGBC Section 5.507.4.3.

2.4 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C645 requirements for steel unless otherwise indicated.
2. Protective Coating: ASTM A653/A653M, G40 (Z120), hot-dip galvanized unless otherwise indicated.

B. Studs and Tracks: ASTM C645. Use either conventional steel studs and tracks or embossed, high-strength steel studs and tracks.

1. Steel Studs and Tracks:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) CEMCO; California Expanded Metal Products Co.
2) ClarkDietrich.
3) Custom Stud.
4) Jaimes Industries.

5) MarinoWARE.
6) MBA Building Supplies.
7) MRI Steel Framing, LLC.
8) Phillips Manufacturing Co.
9) SCAFCO Steel Stud Company.
10) Steel Construction Systems.
11) Telling Industries.
12) The Steel Network, Inc.

b. Minimum Base-Steel Thickness: As indicated on Drawings.
c. Depth: As indicated on Drawings.

2. Embossed, High Strength Steel Studs and Tracks: Roll-formed and embossed with surface deformations to stiffen the framing members so that they are structurally comparable to conventional ASTM C645 steel studs and tracks.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) CEMCO; California Expanded Metal Products Co.
2) ClarkDietrich.
3) MarinoWARE.
4) MBA Building Supplies.
5) Phillips Manufacturing Co.
6) SCAFCO Steel Stud Company.
7) Steel Construction Systems.
8) Telling Industries.
9) The Steel Network, Inc.

b. Minimum Base-Steel Thickness: As indicated on Drawings.
c. Depth: As indicated on Drawings.

C. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Single Long-Leg Track System: ASTM C645 top track with not less than 2 inch (51 mm) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top track and with continuous bridging located not more than 12 inches (305 mm) of the top of studs to provide lateral bracing.
2. Double-Track System: ASTM C645 top outer tracks, inside track with not less than 2 inch (51 mm) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.
3. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) CEMCO; California Expanded Metal Products Co.
2) ClarkDietrich.
3) MarinoWARE.
4) MBA Building Supplies.

5) Metal-Lite.
6) Perfect Wall, Inc.
7) SCAFCO Steel Stud Company.
8) Steel Construction Systems.
9) Telling Industries.
10) The Steel Network, Inc.

D. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. CEMCO; California Expanded Metal Products Co.
b. ClarkDietrich.
c. Fire Trak Corp.
d. MarinoWARE.
e. Metal-Lite.
f. Perfect Wall, Inc.
g. SCAFCO Steel Stud Company.
h. Steel Construction Systems.
i. The Steel Network, Inc.

E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. ClarkDietrich.
b. MarinoWARE.
c. MRI Steel Framing, LLC.
d. SCAFCO Steel Stud Company.
e. Steel Construction Systems.

2. Minimum Base-Steel Thickness: As indicated on Drawings but not less than 0.0329 inch (0.836 mm) thick (20 gage nominal), galvanized steel.

F. Cold-Rolled Channel Bridging: Steel, with not less than 1/2 inch (13 mm) wide flanges.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. ClarkDietrich.
b. MarinoWARE.
c. MRI Steel Framing, LLC.
d. SCAFCO Steel Stud Company.
e. Steel Construction Systems.

2. Minimum Base-Steel Thickness: As indicated on Drawings but not less than 0.0538 inch (1.367 mm) thick (16 gage nominal), galvanized steel.
3. Depth: As indicated on Drawings.

4. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), not less than 0.0677 inch (1.720 mm) thick (14 gage nominal), galvanized steel.

G. Hat-Shaped, Rigid Furring Channels: ASTM C645.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. ClarkDietrich.
   b. Jaimes Industries.
   c. MarinoWARE.
   d. MRI Steel Framing, LLC.
   e. SCAFCO Steel Stud Company.
   f. Steel Construction Systems.

2. Minimum Base-Steel Thickness: As indicated on Drawings but not less than 0.0329 inch (0.836 mm) thick (20 gage nominal), galvanized steel.
3. Depth: 7/8 inch (22.2 mm) unless otherwise indicated.

H. Resilient Furring Channels: Steel, designed to reduce sound transmission.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. ClarkDietrich.
   b. MarinoWARE.
   c. MRI Steel Framing, LLC.
   d. SCAFCO Steel Stud Company.
   e. Steel Construction Systems.

2. Configuration: Asymmetrical.
3. Depth: 1/2 inch (13 mm) unless otherwise indicated.

I. Cold-Rolled Furring Channels: Steel, with not less than 1/2 inch (13 mm) wide flanges.

1. Minimum Base-Steel Thickness: As indicated on Drawings but not less than 0.0538 inch (1.367 mm) thick (16 gage nominal), galvanized steel.
2. Depth: As indicated on Drawings.
3. Furring Brackets: Adjustable, corrugated-edge-type, not less than 0.0329 inch (0.836 mm) thick (20 gage nominal), galvanized steel.
4. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.0625 inch (1.588 mm) diameter wire (16 gage nominal), or double strand of 0.0475 inch (1.207 mm) diameter wire (18 gage nominal).

J. Z-Shaped Furring: With slotted or nonslotted web, face flange of not less than 1-1/4 inches (32 mm), wall attachment flange of not less than 7/8 inch (22 mm).

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. ClarkDietrich.
   b. MarinoWARE.
   c. MRI Steel Framing, LLC.

d. SCAFCO Steel Stud Company.
e. Steel Construction Systems.

2. Minimum Base-Steel Thickness: As indicated on Drawings but not less than 0.0179 inch (0.455 mm) thick (25 gage nominal), galvanized steel.
3. Depth: As required to fit insulation thickness indicated.

2.5 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.0625 inch (1.588 mm) diameter wire (16 gage nominal), or double strand of 0.0475 inch (1.207 mm) diameter wire (18 gage nominal).

B. Hanger Attachments to Concrete:

1. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 or AC193 as appropriate for the substrate.

a. Uses: Securing hangers to structure.
b. Type: Torque-controlled, expansion anchor.
c. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941 (ASTM F1941M), Class Fe/Zn 5, unless otherwise indicated.
d. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F593 (ASTM F738M), and nuts, ASTM F594 (ASTM F836M).

C. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.1620 inch (4.115 mm) diameter wire (8 gage nominal).

D. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with not less than 1/2 inch (13 mm) wide flanges.

1. Minimum Base-Steel Thickness: As indicated on Drawings but not less than 0.0538 inch (1.367 mm) thick (16 gage nominal), galvanized steel.
2. Depth: As indicated on Drawings.

E. Furring Channels (Furring Members):

1. Cold-Rolled Channels: Steel, with not less than 1/2 inch (13 mm) wide flanges.

a. Minimum Base-Steel Thickness: As indicated on Drawings but not less than 0.0538 inch (1.367 mm) thick (16 gage nominal), galvanized steel.
b. Depth: 3/4 inch (19 mm) unless otherwise indicated.

2. Steel Studs and Tracks: ASTM C645.

a. Minimum Base-Steel Thickness: As indicated on Drawings.
b. Depth: As indicated on Drawings.

3. Embossed, High-Strength Steel Studs and Tracks: ASTM C645.

a. Minimum Base-Steel Thickness: As indicated on Drawings.

b. Depth: As indicated on Drawings.

4. Hat-Shaped, Rigid Furring Channels: ASTM C645.

a. Minimum Base-Steel Thickness: As indicated on Drawings but not less than 0.0329 inch (0.836 mm) thick (20 gage nominal), galvanized steel.
b. Depth: 7/8 inch (22.2 mm) unless otherwise indicated.

5. Resilient Furring Channels: Steel, designed to reduce sound transmission.

a. Configuration: Asymmetrical.
b. Depth: 1/2 inch (13 mm) unless otherwise indicated.

F. Grid Suspension System for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Armstrong World Industries, Inc.
b. Rockfon (Rockwool International).
c. USG Corporation.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:

1. Asphalt-Saturated Organic Felt: ASTM D226/D226M, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

C. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

D. Sound Attenuation Blankets: As specified in Section 092900 "Gypsum Board."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling tracks to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches (610 mm) o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that are required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.

1. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C1063 that apply to framing installation.
2. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Single-Layer Application: 16 inches (406 mm) o.c. unless otherwise indicated.
2. Multilayer Application: 16 inches (406 mm) o.c. unless otherwise indicated.
3. Tile Backing Panels: 16 inches (406 mm) o.c. unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with not less than 1/2 inch (13 mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

    a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
6. Curved Partitions:

    a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
    b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches (150 mm) o.c.

E. Direct Furring:

1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

F. Z-Shaped Furring Members:

1. Erect insulation, specified in Section 072100 "Thermal Insulation," vertically and hold in place with Z-shaped furring members spaced 24 inches (610 mm) o.c. or as required to fit insulation.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member not more than 12 inches (305 mm) from corner and cut insulation to fit.

G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

3.5 INSTALLING CEILING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Hangers: Not more than 48 inches (1219 mm) o.c. unless otherwise indicated.
2. Carrying Channels (Main Runners): Not more than 48 inches (1219 mm) o.c. unless otherwise indicated.
3. Furring Channels (Furring Members): Not more than 16 inches (406 mm) o.c. unless otherwise indicated.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

    a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

    a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Do not attach hangers to steel roof deck.
5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
7. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Seismic Bracing: Sway-brace suspension systems as indicated and as required by referenced installation standards.

F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 092400 - CEMENT PLASTERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exterior vertical plasterwork (stucco).
2. Exterior horizontal and nonvertical plasterwork (stucco).

B. Related Sections:

1. Section 054000 "Cold-Formed Metal Framing" for structural, load-bearing (transverse and axial) steel studs and joists that support lath and portland cement plaster.
2. Section 061600 "Sheathing" for sheathing included in portland cement plaster assemblies.
3. Section 072100 "Thermal Insulation" for thermal insulations included in portland cement plaster assemblies.
4. Section 072500 "Weather Barriers" for water-resistant barriers included in portland cement plaster assemblies.
5. Section 092216 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support lath and portland cement plaster.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.

C. Samples for Verification: For each type of factory-prepared finish coat and for each color and texture specified, 24 by 24 inches (610 by 610 mm), and prepared on rigid backing.

1.5 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockups for each substrate and finish texture indicated for cement plastering, including accessories.

a. Size: 100 sq. ft. (9 sq. m) in surface area.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover, and keep them dry and protected against damage from weather, moisture, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.7 FIELD CONDITIONS

A. Comply with ASTM C926 requirements.

B. Exterior Plasterwork:

1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
2. Apply plaster when ambient temperature is greater than 40 deg F (4.4 deg C).
3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.

C. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: Where indicated, provide cement plaster assemblies identical to those of assemblies tested for fire resistance according to ASTM E119 by a qualified testing agency.

B. STC-Rated Assemblies: Provide materials and construction identical to those of assemblies tested according to ASTM E 90 and classified according to ASTM E 413 by a testing and inspecting agency.

1. STC Rating: Not less than 50 unless otherwise indicated.

2.2 REGULATORY REQUIREMENTS

A. All insulation provided for use on this project shall be identified as required by Section 12-13-1557 of the California Referenced Standards Code (Part 12, Title 24, C.C.R.); Chapter 12-13 "Standards For Insulating Material", (See Part 6, Title 24, C.C.R.); Department Of Consumer Affairs, Bureau of Home Furnishings and Thermal Insulation; Article 3: "Standards for Insulating Material".

2.3 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Recycled Content of Steel Products: Recycled content not less than 20 percent.

C. Finish Material Pollutant Control: Finish materials shall comply with CGBC Sections 5.504.4.1 through 5.504.4.6 per CGBC Section 5.504.4.

1. Adhesives, Sealants, and Caulks: Adhesives, sealants, and caulks used on the project shall meet the requirements of the following standards per CGBC Section 5.504.4.1:

a. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in CBC Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products specified in subparagraph below.
b. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

2. Sealants and sealant primers shall comply with maximum VOC limits listed in CGBC Table 5.504.4.2.

D. VOC Content: Sealants and sealant primers shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Architectural Sealants: 250 g/L.
2. Architectural Sealant Primers for Nonporous Substrates: 250 g/L.
3. Architectural Sealant Primers for Porous Substrates: 775 g/L.

E. Low-Emitting Materials: Sealants and sealant primers shall comply with the requirements of authorities having jurisdiction.

F. Thermal Insulation, Tier 1: Comply with the following standards per CGBC Section A5.504.4.8:

1. Chapters 12-13 (Standards for Insulating Material) in Title 24, Part 12, the California Referenced Standards Code.
2. The VOC-emission limits defined in 2009 CHPS criteria and listed in its High Performance Products Database.

3. California Department of Public Health 2010 Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1, February 2010 (also known as Specification 01350).

G. Thermal Insulation, Tier 2: Thermal insulation, No-added Formaldehyde. Install thermal insulation which complies with Tier 1 plus does not contain any added formaldehyde per CGBC Section A5.504.4.8.1.

H. Provide glass-fiber blanket insulation as follows:

1. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05 ppm formaldehyde.
2. Recycled Content: Recycled content not less than 20 percent.

I. Provide mineral-wool blanket insulation as follows:

1. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05 ppm formaldehyde.
2. Recycled Content: Recycled content not less than 20 percent.

2.4 METAL LATH

A. Wire-Fabric Lath:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Structa Wire Corp.; Mega Lath, or comparable product by one of the following:

a. Davis Wire; a Heico Wire Group company.
b. Jaenson Wire Company.
c. Keystone Steel & Wire Co.
d. K-Lath; a Tree Island Steel Ltd. company.

2. Welded-Wire Lath: ASTM C933; self-furring, 1.95 lb/sq. yd. (1.1 kg/sq. m).

B. Paper-Backed Wire-Fabric Lath:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Structa Wire Corp.; V-Truss Walls & Ceilings, or comparable product by one of the following:

a. Davis Wire; a Heico Wire Group company.
b. Jaenson Wire Company.
c. Keystone Steel & Wire Co.
d. K-Lath; a Tree Island Steel Ltd. company.

2. Welded-Wire Lath: ASTM C933; self-furring, 2.2 lb/sq. yd. (1.24 kg/sq. m).

2.5 ACCESSORIES

A. General: Comply with ASTM C1063, and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.

B. Metal Accessories:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Alabama Metal Industries Company; a Gibraltar Industries company.
   b. CEMCO; California Expanded Metal Products Co.
   c. ClarkDietrich.
   d. MarinoWARE.
   e. Phillips Manufacturing Co.

2. Foundation Weep Screed: Fabricated from hot-dip galvanized-steel sheet, ASTM A653/A653M, G60 (Z180) zinc coating.
3. Cornerite: Fabricated from metal lath with ASTM A653/A653M, G60 (Z180), hot-dip galvanized-zinc coating.
4. External- (Outside-) Corner Reinforcement: Fabricated from metal lath with ASTM A653/A653M, G60 (Z180), hot-dip galvanized-zinc coating.
5. Casing Beads: Fabricated from zinc or zinc-coated (galvanized) steel; square-edged style; with expanded flanges.
6. Control Joints: Fabricated from zinc or zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
7. Two-Piece Expansion Joints: Fabricated from zinc or zinc-coated (galvanized) steel; formed to produce slip-joint and square-edged reveal that is adjustable from 1/4 to 5/8 inch (6 to 16 mm) wide; with perforated flanges.

2.6 MISCELLANEOUS MATERIALS

A. Water for Mixing and Finishing Plaster: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.

B. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch (13 mm) long, free of contaminants, manufactured for use in cement plaster.

C. Bonding Compound: ASTM C932.

D. Fasteners for Attaching Metal Lath to Substrates: ASTM C1063.

E. Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, not less than 0.0475 inch (1.207 mm) diameter wire (18 gage nominal) unless otherwise indicated.

F. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

G. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

2.7 PLASTER MATERIALS

A. Scratch and Brown Coats:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Parex, a brand of Parex USA, Inc.; En-Rock Type F Base Stucco, or a comparable product by another manufacturer.

a. Fiber-reinforced, factory blended Portland cement, and proprietary ingredients, cement scratch and brown coat conforming to ASTM C 926. Mix with En-Rock FR-100 Admixture and ASTM C 897 or ASTM C 144 washed plaster sand.

2. Basis-of-Design Product: Subject to compliance with requirements, provide Parex, a brand of Parex USA, Inc.; En-Rock FR-100 Admixture, or a comparable product by another manufacturer.

a. A water-based, liquid polymer emulsion admixture for use with cement-based products containing not less than 35 percent solids by weight.

B. Leveling and Reinforcing Coat:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Parex, a brand of Parex USA, Inc.; 121 Dry Base Coat and Adhesive, or a comparable product by another manufacturer.

a. Water-based, VOC compliant copolymer based, factory blend of cement and proprietary ingredients requiring the addition of water; designed for use with stucco base coats and adhesives to achieve a smooth, level surface.

2. Reinforcing Mesh:

a. Basis-of-Design Product: Subject to compliance with requirements, provide Parex, a brand of Parex USA, Inc.; 355 Standard Mesh, or a comparable product by another manufacturer.

1) Weight 4.5 oz./sq. yd. (153 g/sq. m) reinforcing mesh.

b. Basis-of-Design Product: Subject to compliance with requirements, provide Parex, a brand of Parex USA, Inc.; 356 Detail Mesh, or a comparable product by another manufacturer.

1) Weight 4.5 oz./sq. yd. (153 g/sq. m) 9-1/2 inches (241 mm) wide reinforcing mesh.

c. Basis-of-Design Product: Subject to compliance with requirements, provide Parex, a brand of Parex USA, Inc.; 358.10 Intermediate Mesh, or a comparable product by another manufacturer.

1) Weight 12 oz./sq. yd. (407 g/sq. m) reinforcing mesh.

C. Finish:

1. Basis-of-Design Product: Subject to compliance with requirements, provide LaHabra, a brand of ParexLaHabra, Inc.; Santa Barbara Mission Finish, or a comparable product by another manufacturer.

a. Factory blended, portland cement based finish, integrally colored smooth trowel, polymer modified stucco. Mix with Adacrly Admix & Bonding Agent.
b. Color: Match Architect's sample as closely as possible using no organic pigments.

2. Basis-of-Design Product: Subject to compliance with requirements, provide Parex, Inc., a brand of ParexLaHabra, Inc.; Adacrly Admix & Bonding Agent, or a comparable product by another manufacturer.

   a. Add liquid polymer admix at the rate of 1 quart per 90 lb. bag of portland cement based finish.

2.8 PLASTER MIXES

A. General: Comply with ASTM C926 for applications indicated.

1. Fiber Content: Add fiber to base-coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu. yd. (0.6 kg of fiber/cu. m) of cementitious materials.

B. Factory-Prepared Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork, comply with manufacturer's written instructions.

C. Base-Coat Mixes for Use over Solid Surfaces: Single base (scratch) coat for two-coat plasterwork, comply with manufacturer's written instructions.

D. Factory-Prepared Finish-Coat Mixes: For ready-mixed finish-coat plasters and acrylic-based finish coatings, comply with manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.

B. Prepare smooth, solid substrates for plaster according to ASTM C926.

3.3 INSTALLATION, GENERAL

A. Fire-Resistance-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.

B. Sound-Attenuation Blankets: Where required, install blankets before installing lath unless blankets are readily installed after lath has been installed on one side.

C. Acoustical Sealant: Where required, seal joints between edges of plasterwork and abutting construction with acoustical sealant.

3.4 INSTALLING METAL LATH

A. Metal Lath: Install according to ASTM C1063.

1. Partition Framing and Vertical Furring: Install self-furring, welded-wire lath.
2. Flat-Ceiling flat-soffit, and Horizontal Framing: Install self-furring, paper-backed, welded-wire lath.
3. On Solid Surfaces, Not Otherwise Furred: Install self-furring, welded-wire lath.

3.5 INSTALLING ACCESSORIES

A. Install according to ASTM C1063 and at locations indicated on Drawings.

B. Reinforcement for External (Outside) Corners:

1. Install lath-type, external-corner reinforcement at exterior locations.

C. Reinforcement for Internal (Inside) Corners:

1. Install cornerite, internal-corner reinforcement at exterior locations.

D. Control Joints: Locate as indicated on Drawings or, if not indicated, in specific locations approved by Architect for visual effect and as follows:

1. As required to delineate plasterwork into areas (panels) of the following maximum sizes:

   a. Vertical Surfaces: 144 sq. ft. (13.4 sq. m).
   b. Horizontal and Other Nonvertical Surfaces: 100 sq. ft. (9.3 sq. m).

2. At distances between control joints of not greater than 18 feet (5.5 m) o.c.
3. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
4. Where control joints occur in surface of construction directly behind plaster.
5. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

E. Expansion Joints: Install expansion joints at locations indicated on Drawings or, if not indicated, in specific locations approved by Architect for visual effect as follows:

1. Where expansion joints occur in surface of construction directly behind plaster.
2. Where plaster transitions across different substrates.

3.6 MIXING

A. Mix stucco materials in accordance with manufacturer's instructions, including the applicable technical bulletins and product data sheets.

B. Admix and Bonding Agent:

1. Type F Stucco Base and FR-100 Admixture: Mix 3.5 gal of admixture and 3.5 gallons of water per two 80 lb. bags of Parex En-Rock Type F Stucco Base. Mix water and admixture completely before adding dry components.
2. Add Type F Stucco Base and 5 - 6 cu. ft. (400-480 lbs or 182 -218 kgs) of ASTM C 897 or ASTM C 144 washed plaster sand according to manufacturer's instructions. Mix no longer than required to provide a uniform mixture. If needed, add water for workability.
3. Do not over mix. Overmixing entrains excessive amounts of air which weaken the material.
4. Use Type F Stucco Base immediately after mixing. Do not retemper Type F Stucco Base.

3.7 PLASTER APPLICATION

A. General: Comply with ASTM C926.

1. Do not deviate more than plus or minus 1/4 inch in 10 feet (6 mm in 3 m) from a true plane in finished plaster surfaces when measured by a 10 foot (3 m) straightedge placed on surface.
2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
3. Provide plaster surfaces that are ready to receive field-applied finishes indicated.

B. Bonding Compound: Apply on solid surface substrates for direct application of plaster.

C. Walls; Base-Coat Mixes for Use over Metal Lath: For scratch and brown coats, for three-coat plasterwork with 3/4 inch (19 mm) total thickness.

D. Ceilings; Base-Coat Mixes for Use over Metal Lath: For scratch and brown coats, for three-coat plasterwork and having 3/4 inch (19 mm) total thickness.

E. Walls; Base-Coat Mix for Use over Solid Surfaces: For base (scratch) coat, for two-coat plasterwork and having 3/8 inch (10 mm) total thickness.

A. Scratch Coat:

1. Apply scratch coat to a minimum thickness of 3/8 inch (10 mm), using sufficient trowel pressure to key stucco into lath or to create bond to substrates as applicable.
2. Prior to initial set, scratch horizontally or in one direction on ceilings to provide key for bond of brown coat.

B. Brown Coat:

1. Apply brown coat to a minimum thickness of 3/8 inch (10 mm), using sufficient trowel pressure to key stucco into scratch coat.
2. Rod surface to true plane.
3. As a substrate for smooth finishes, cut back approximately 1/16 inch (1.6 mm) deep around all trims and accessories to allow the finish to level off flush to the trim edges.
4. Float to densify, begin floating only after hydration of the cement has commenced and sufficient moisture has evaporated so that surface sheen has disappeared, but before the base coat has become too rigid to be moved under float.
5. Examine the cured base coat for any irregularities. Correct these irregularities to produce a flat surface.

6. Reinforcing and leveling coat may be applied as soon as the base coat is uniformly dry, approximately 24 hours after application.

C. Leveling and Reinforcing Coat:

1. Apply level coat over scratch / brown coat at a thickness of 1/16 to 3/32 inch (1.6 to 2.4 mm).
2. Fully embed reinforcing mesh into the wet level coat and trowel smooth.

a. If 355 standard mesh is used, seams shall be overlapped 2-1/2 inches (63 mm).
b. If the 358.10 intermediate mesh is used, seams shall be butted and covered by strips of 356 detail mesh.

3. Examine the cured base coat for any irregularities.
4. Correct these irregularities to produce a flat surface.
5. Before the application of the finish, the leveling and reinforcing coat must have cured a minimum of 24 hours or longer as required by conditions.

D. Apply specified exterior wall finish in number of coats and thickness recommended by manufacturer to achieve texture indicated, using sufficient pressure to bond finish to base coat(s).

1. Plaster Finish Coats: Apply to provide smooth finish unless indicated otherwise.

a. When patching existing cement plaster; apply plaster finish coats to match existing.

E. Acrylic-Based Finish Coatings: Apply coating system, including primers, finish coats, and sealing topcoats, according to manufacturer's written instructions.

F. Curing:

1. Type F Stucco Base: No moist curing required.

a. Protect plaster from uneven and excessive evaporation during hot, dry weather by tarping or covering.
b. Base coats must have cured a minimum of 24 hours or longer as required by conditions, the application of the reinforcing and leveling coat, and finish.
c. Air cure stucco base coats, level coat, and finish coat only; do not wet cure.

3.8 PLASTER REPAIRS

A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.9 CLEANING AND PROTECTION

A. Remove temporary protection and enclosure of other work after plastering is complete. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION 092400

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior gypsum board.

B. Related Requirements:

1. Section 054000 "Cold-Formed Metal Framing" for load-bearing and exterior non-load-bearing steel framing and suspension systems that support gypsum board panels.
2. Section 061600 "Sheathing" for gypsum sheathing for exterior walls.
3. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for metal shaft wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.
4. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.
5. Section 093013 "Ceramic Tiling" for cementitious backer units installed as substrates for ceramic tile.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 QUALITY ASSURANCE

A. Mockups: Build mockups of not less than 100 sq. ft. (9 sq. m) in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Build mockups for the following:

a. Each level of gypsum board finish indicated for use in exposed locations.

2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.
4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

B. All materials shall be delivered in original bundles bearing the brand name, if any; applicable standard designation; and name of the manufacturer or supplier for whom the product is manufactured.

1. The plastic packaging used to wrap gypsum panel products for rail and/or truck shipment is intended to provide temporary protection from moisture exposure during transit only and is not intended to provide protection during storage after delivery. Such plastic packaging shall be removed immediately upon receipt of the shipment.

a. Failure to remove protective plastic shipping covers can result in condensation which can lead to damage, including mold.

C. All materials shall be kept dry. Gypsum panel products shall be neatly stacked flat with care taken to prevent sagging or damage to edges, ends, and surfaces.

1. Gypsum panel products and accessories shall be properly supported on a level platform, and fully protected from weather, direct sunlight exposure, and condensation.

D. Gypsum panel products shall be protected from elements before, during, after construction

1.6 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

1. Gypsum panels installed in areas that are not enclosed and conditioned shall have fiberglass mat laminated to both sides and manufacturer's 12 month exposure warranty.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

1. Exterior Wall STC Rating: Not less than 50 unless otherwise indicated.
2. Shaft Wall STC Rating: Not less than 50 unless otherwise indicated.
3. Interior Wall STC Rating: Not less than 40 unless otherwise indicated.
4. Interior Wall STC Rating at Audio/Video Room: Not less than 65 unless otherwise indicated.

2.2 REGULATORY REQUIREMENTS

A. All insulation provided for use on this project shall be identified as required by Section 12-13-1557 of the California Referenced Standards Code (Part 12, Title 24, C.C.R.); Chapter 12-13 "Standards For Insulating Material", (See Part 6, Title 24, C.C.R.); Department Of Consumer Affairs, Bureau of Home Furnishings and Thermal Insulation; Article 3: "Standards for Insulating Material".

2.3 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Regional Materials: Gypsum panel products shall be manufactured within 500 miles (800 km) of Project site.

C. Recycled Content of Steel Products: Recycled content not less than 20 percent.

D. Recycled Content of Gypsum Panel Products: Recycled content not less than 20 percent by weight.

E. Finish Material Pollutant Control: Finish materials shall comply with CGBC Sections 5.504.4.1 through 5.504.4.6 per CGBC Section 5.504.4.

1. Adhesives, Sealants, and Caulks: Adhesives, sealants, and caulks used on the project shall meet the requirements of the following standards per CGBC Section 5.504.4.1:

   a. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in CBC Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products specified in subparagraph below.
   b. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

2. Adhesives shall comply with maximum VOC limits listed in CGBC Table 5.504.4.1.

F. VOC Content: Adhesives shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Drywall and Panel Adhesives: 50 g/L.

G. Thermal Insulation, Tier 1: Comply with the following standards per CGBC Section A5.504.4.8:

1. Chapters 12-13 (Standards for Insulating Material) in Title 24, Part 12, the California Referenced Standards Code.
2. The VOC-emission limits defined in 2009 CHPS criteria and listed in its High Performance Products Database.
3. California Department of Public Health 2010 Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1, February 2010 (also known as Specification 01350).

H. Thermal Insulation, Tier 2: Thermal insulation, No-added Formaldehyde. Install thermal insulation which complies with Tier 1 plus does not contain any added formaldehyde per CGBC Section A5.504.4.8.1.

I. Provide glass-fiber blanket insulation as follows:

1. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05 ppm formaldehyde.
2. Recycled Content: Recycled content not less than 20 percent.

J. Provide mineral-wool blanket insulation as follows:

1. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05 ppm formaldehyde.
2. Recycled Content: Recycled content not less than 20 percent.

K. Interior Sound Transmission: Wall and floor-ceiling assemblies separating tenant spaces and tenant spaces and public spaces shall have an STC of at least 40 per CGBC Section 5.507.4.3.

L. Low-Emitting Adhesives: Adhesives shall comply with the requirements of authorities having jurisdiction.

M. Low-Emitting Materials: Gypsum board wall, ceiling, and soffit assemblies shall comply with the requirements of authorities having jurisdiction.

2.4 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.5 INTERIOR GYPSUM BOARD

A. Gypsum Board, Type X: ASTM C 1396/C 1396M. UL Classification: ULIX.

1. Basis-of-Design Product: Subject to compliance with requirements, provide United States Gypsum Company; USG Sheetrock Brand, EcoSmart Panels, Firecode X, or a comparable product by one of the following:

a. American Gypsum.
b. CertainTeed Corporation.
c. Continental Building Products, LLC.
d. Georgia-Pacific Building Products.

e. National Gypsum Company.
f. PABCO Gypsum.
g. Temple-Inland Building Products by Georgia-Pacific.

2. ISO 14040 Environmental Management, Life Cycle Assessment, Principles and Framework:

a. Carbon emissions limit per Gypsum Association; Industry Standard Type III EPD for North American Type X wallboard with a manufacturing Global Warming Potential of 225 kg CO2 / 1000 sq ft.
b. Water reduction per Gypsum Association; Industry Standard Type III EPD for North American Type X wallboard having a manufacturing Virtual Water of 1.0 cu m / 1000 sq ft.
c. Primary energy from non-renewable resources 3997 MJ / 1000 sq ft.

3. UL Type Designation: ULIX.
4. ASTM E 136 Non-Combustibility: Meets or exceeds criteria.
5. ASTM E 84 Surface-Burning Characteristics:

a. Flame Spread: 15.
b. Smoke Developed: 5.
c. Classification: Class A.

6. ASTM C 473:

a. Core Hardness: Meets or exceeds 11 (ASTM C 473 B).
b. Flexural Strength:

1) Parallel: Not less than 46 lb ft.
2) Perpendicular: Not less than 147 lb ft.

c. Nail Pull Resistance ASTM C 473 B: Not less than 87 lb ft.

7. Thickness: 5/8 inch (15.9 mm).
8. Weight: 1.75 to 1.85 lb / sq ft.
9. Long Edges: Tapered.

B. Abuse-Resistant Gypsum Board: ASTM C1396/C1396M gypsum board, tested according to ASTM C1629/C1629M.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. American Gypsum.
b. CertainTeed Corporation.
c. Continental Building Products, LLC.
d. Georgia-Pacific Gypsum LLC.
e. National Gypsum Company.
f. PABCO Gypsum.
g. USG Corporation.

2. Core: 5/8 inch (15.9 mm), Type X.
3. Surface Abrasion: ASTM C1629/C1629M, meets or exceeds Level 2 requirements.
4. Indentation: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.

5. Soft-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 3 requirements.
6. Hard-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 3 requirements according to test in Annex A1.
7. Long Edges: Tapered.
8. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

C. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. American Gypsum.
    b. CertainTeed Corporation.
    c. Continental Building Products, LLC.
    d. Georgia-Pacific Gypsum LLC.
    e. National Gypsum Company.
    f. PABCO Gypsum.
    g. USG Corporation.

2. Core: 5/8 inch (15.9 mm), Type X.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.6 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:

    a. Cornerbead.
    b. LC-Bead: J-shaped; exposed long flange receives joint compound.
    c. L-Bead: L-shaped; exposed long flange receives joint compound.
    d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    e. Expansion (control) joint.
    f. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Flannery, Inc.
    b. Fry Reglet Corporation.
    c. Gordon, Inc.
    d. Pittcon Industries.

2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B221 (ASTM B221M), Alloy 6063-T5.
3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.7 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.

2.8 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.

D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

E. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

F. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4 to 3/8 inch (6.4 to 9.5 mm) wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4 to 1/2 inch (6.4 to 12.7 mm) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Type X/ULIX: Unless otherwise indicated.
2. Abuse-Resistant Type: Where indicated on Drawings.
3. Mold-Resistant Type: Where indicated on Drawings.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) or horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.

3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws or fasten base layers with screws and fasten face layers with adhesive and supplementary fasteners.

D. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12 inch (300 mm) long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches (400 mm) o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches (300 mm) o.c.

3.4 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints at locations indicated on Drawings or, if not indicated, according to ASTM C840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners unless otherwise indicated.
2. LC-Bead: Use at exposed panel edges unless otherwise indicated.
3. L-Bead: Use where indicated.
4. U-Bead: Use where indicated.
5. Curved-Edge Cornerbead: Use at curved openings.

D. Aluminum Trim: Install in locations indicated on Drawings.

3.5 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for plastic paneling and where indicated on Drawings.

    a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

3. Level 3: At panel surfaces that will not be exposed to view such as those in mechanical and electrical rooms and where indicated on Drawings.

    a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

    a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

3.6 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

This page intentionally left blank.

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Ceramic mosaic tile.
2. Glazed wall tile.
3. Stone thresholds.
4. Crack isolation membrane.
5. Metal edge strips.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."

C. Face Size: Actual tile size, excluding spacer lugs.

D. Module Size: Actual tile size plus joint width indicated.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.
2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples not less than 36 inches (900 mm) square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.
3. Full-size units of each type of trim and accessory for each color and finish required.
4. Stone thresholds in 6 inch (150 mm) lengths.
5. Metal edge strips in 6 inch (150 mm) lengths.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

C. Product Certificates: For each type of product.

D. Product Test Reports: For tile-setting and -grouting products and certified porcelain tile.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer is a Five-Star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.

1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
2. Obtain crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:

1. Stone thresholds.
2. Crack isolation membrane.
3. Joint Sealants.
4. Metal edge strips.

2.2 ACCESSIBILITY REQUIREMENTS

A. Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

B. Floor or Ground Surfaces:

1. General: Floor and ground surfaces shall be stable, firm, and slip resistant and shall comply with CBC Section 11B-302 per CBC Section 11B-302.1.

a. Exceptions:

1) Within animal containment areas, floor and ground surfaces shall not be required to be stable, firm, and slip resistant.
2) Areas of sport activity shall not be required to comply with CBC Section 11B-302.

C. Changes in Level:

1. General: Where changes in level are permitted in floor or ground surfaces, they shall comply with CBC Section 11B-303 per CBC Section 11B-303.1.

a. Exceptions:

1) Animal containment areas shall not be required to comply with CBC Section 11B-303.
2) Areas of sport activity shall not be required to comply with CBC Section 11B-303.

2. Vertical: Changes in level of 1/4 inch (6.4 mm) high maximum shall be permitted to be vertical and without edge treatment per CBC Section 11B-303.2 and CBC Figure 11B-303.2.
3. Beveled: Changes in level between 1/4 inch (6.4 mm) high minimum and 1/2 inch (12.7 mm) high maximum shall be beveled with a slope not steeper than 1:2 per CBC Section 11B-303.3 and CBC Figure 11B-303.3.

D. Thresholds: Thresholds, if provided at doorways, shall be 1/2 inch (12.7 mm) high maximum. Raised thresholds and changes in level at doorways shall comply with CBC Sections 11B-302 and 11B-303 per CBC Section 11B-404.2.5.

2.3 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Finish Material Pollutant Control: Finish materials shall comply with CGBC Sections 5.504.4.1 through 5.504.4.6 per CGBC Section 5.504.4.

1. Adhesives, Sealants, and Caulks: Adhesives, sealants, and caulks used on the project shall meet the requirements of the following standards per CGBC Section 5.504.4.1:

a. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in CBC Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products specified in subparagraph below.
b. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements,

including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

2. Adhesives shall comply with maximum VOC limits listed in CGBC Table 5.504.4.1.
3. Sealants and sealant primers shall comply with maximum VOC limits listed in CGBC Table 5.504.4.2.

C. VOC Content: Adhesives shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Ceramic Tile Adhesives: 65 g/L.

D. VOC Content: Sealants and sealant primers shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Architectural Sealants: 250 g/L.
2. Architectural Sealant Primers for Nonporous Substrates: 250 g/L.
3. Architectural Sealant Primers for Porous Substrates: 775 g/L.

E. Low-Emitting Materials: Adhesives shall comply with the requirements of authorities having jurisdiction.

F. Low-Emitting Materials: Sealants and sealant primers shall comply with the requirements of authorities having jurisdiction.

2.4 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

2.5 TILE PRODUCTS

A. Floor Tile: Factory-mounted unglazed ceramic mosaic tile.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. American Marazzi Tile, Inc.
    b. American Olean; a division of Dal-Tile Corporation.
    c. Crossville, Inc.
    d. Daltile.
    e. Deutsche Steinzeug America, Inc.
    f. Grupo Porcelanite.
    g. Interceramic.
    h. Iris US.
    i. Jeffrey Court Inc.
    j. Lone Star Ceramics; Elgin Butler.
    k. Portobello America, Inc.
    l. Seneca Tiles, Inc.

2. Composition: Porcelain.
3. Certification: Porcelain tile certified by the Porcelain Tile Certification Agency.
4. Module Size: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.
5. Thickness: 1/4 inch (6.4 mm) unless otherwise indicated.
6. Face: Plain with cushion edges unless otherwise indicated.
7. Surface: Smooth, without abrasive admixture unless otherwise indicated.
8. Dynamic Coefficient of Friction: Not less than 0.42.
9. Finish: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.
10. Tile Color and Pattern: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.
11. Grout Color: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

B. Wall Tile: Glazed wall tile.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. American Marazzi Tile, Inc.
    b. American Olean; a division of Dal-Tile Corporation.
    c. Daltile.
    d. Grupo Porcelanite.
    e. Jeffrey Court Inc.
    f. Seneca Tiles, Inc.

2. Module Size: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.
3. Face Size Variation: Rectified.
4. Thickness: 5/16 inch (8 mm) unless otherwise indicated.
5. Face: Plain with modified square edges or cushion edges unless otherwise indicated.
6. Finish: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.
7. Tile Color and Pattern: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

8. Grout Color: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.
9. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

    a. Base for Portland Cement Mortar Installations: Coved, module size same size as adjoining flat tile unless otherwise indicated.
    b. Wainscot Cap for Portland Cement Mortar Installations: Bullnose cap, module size same size as adjoining flat tile unless otherwise indicated.
    c. External Corners for Portland Cement Mortar Installations: Bullnose shape, module size same size as adjoining flat tile unless otherwise indicated, with radius of not less than 3/4 inch (19 mm) unless otherwise indicated.
    d. Internal Corners for Portland Cement Mortar Installations: Coved, module size same size as adjoining flat tile unless otherwise indicated. For coved base and cap use angle pieces designed to fit with stretcher shapes.

2.6 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or not more than 1/16 inch (1.5 mm) above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to not more than 1/2 inch (12.7 mm) above adjacent floor surface.

B. Granite Thresholds: ASTM C615/C615M, with honed finish.

1. Description: Uniform, fine-grained, gray stone without veining.

2.7 CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.12 for high performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Noble Company (The); Nobleseal CIS, or a comparable product by another manufacturer.
2. Nominal Thickness: 0.030 inch (0.76 mm).

Property	Test Method	Units	Typical Value
System Performance	ASTM C 627	cycles	1-14 "Extra Heavy Service"
Hardness	ASTM D 2240	Shore A	82
Breaking Strength		psi	1243
Water Vapor Transmission	ASTM E 96/96M (Procedure E, 90% RH)	perms	0.15
Dimensional Stability	ANSI A118.10	%	0
Shear Strength (7 day/4 week/12 week)	ANSI A118.10	psi	passed
Shear Strength - Water Immersion (7 day)	ANSI A118.10	psi	passed
Fungus and Microorganism Resistance	ANSI A118.10	no growth	passed
Waterproofness	ANSI A118.10	perms	passed
Crack Isolation	ANSI A118.12	Jig test	"High Performance"

2.8 SETTING MATERIALS

A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.

1. Reinforcing Wire Fabric: Galvanized, welded-wire fabric, 2 by 2 inches (50.8 by 50.8 mm) by 0.062 inch (1.57 mm) diameter; comply with ASTM A185/A185M and ASTM A82/A82M, except for minimum wire size.
2. Latex Additive: Manufacturer's standard acrylic resin or styrene-butadiene-rubber water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.

B. Improved Modified Dry-Set Mortar (Thinset): ANSI A118.15.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Custom Building Products; ProLite Tile & Stone Mortar, or a comparable product by one of the following:

   a. ARDEX Americas.
   b. Bonsal American, an Oldcastle company.
   c. C-Cure.
   d. H.B. Fuller Construction Products Inc. / TEC.
   e. LATICRETE SUPERCAP, LLC.
   f. MAPEI Corporation.
   g. Merkrete; a Parex USA, Inc. brand.
   h. Siena Products; Omega.

2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.15.

2.9 GROUT MATERIALS

A. High-Performance Tile Grout: ANSI A118.7.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Custom Building Products; Prism Color Consistent Grout, or a comparable product by one of the following:

   a. ARDEX Americas.
   b. Boiardi Products Corporation; a QEP company.
   c. Bonsal American, an Oldcastle company.
   d. Bostik, Inc.
   e. C-Cure.
   f. H.B. Fuller Construction Products Inc. / TEC.
   g. Jamo Inc.
   h. LATICRETE SUPERCAP, LLC.
   i. MAPEI Corporation.
   j. Southern Grouts & Mortars, Inc.
   k. Summitville Tiles, Inc.

2. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.

2.10 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Section 07 92 00 "Joint Sealants."

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.

2.11 MISCELLANEOUS MATERIALS

A. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A666, 300 Series exposed-edge material.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   a. Blanke Corporation.
   b. Ceramic Tool Company, Inc.
   c. Schluter Systems L.P.

B. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

C. Grout Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Custom Building Products; Surfaceguard Sealer, or a comparable product by one of the following:

    a. Bonsal American, an Oldcastle company.
    b. Jamo Inc.
    c. Southern Grouts & Mortars, Inc.
    d. Summitville Tiles, Inc.

2.12 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with bonded mortar bed comply with surface finish requirements in ANSI A108.01 for installations indicated.

    a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.

B. Where indicated, prepare substrates to receive crack isolation membrane by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION OF CERAMIC TILE

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:

    a. Tile floors in wet areas.
    b. Tile floors consisting of tiles 8 by 8 inches (200 by 200 mm) or larger.
    c. Tile floors consisting of rib-backed tiles.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
4. Joints between tiles shall be continuous straight lines unless otherwise indicated.

G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Floor Tile: 1/8 inch (3.2 mm) unless otherwise indicated.
2. Wall Tile: 1/8 inch (3.2 mm) unless otherwise indicated.

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

J. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

1. Do not extend crack isolation membrane under thresholds set in improved modified dry-set mortar. Fill joints between such thresholds and adjoining tile set on crack isolation membrane with elastomeric sealant.

K. Metal Edge Strips: Install at locations indicated and where exposed edge of tile flooring meets carpet, wood, or other flooring and no threshold is indicated.

L. Grout Sealer: Apply grout sealer to cementitious grout joints according to grout sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 INSTALLATION OF CRACK ISOLATION MEMBRANE

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.

B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

3.5 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.6 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.7 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:

1. Ceramic Floor Tile Installation with Crack Isolation Membrane (Full Coverage): TCNA F112, TCNA F125-Full, and ANSI A108.1B; cement mortar bed (thickset) bonded to concrete with crack isolation membrane over mortar bed.

a. Ceramic Tile Type: Floor tile.
b. Bond Coat for Cured-Bed Method: Improved modified dry-set mortar.
c. Grout: High-performance unsanded grout.

B. Interior Wall Installations, Metal Studs or Furring:

1. Ceramic Wall Tile Installation: TCNA W231/W241 and ANSI A108.1B; cement mortar bed (thickset).

a. Ceramic Tile Type: Wall tile.
b. Bond Coat for Cured-Bed Method: Improved modified dry-set mortar.
c. Grout: High-performance unsanded grout.

END OF SECTION 093013

This page intentionally left blank.

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for interior ceilings.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:

1. Acoustical Panels: Set of not less than 6 inch (150 mm) square Samples of each type, color, pattern, and texture.
2. Exposed Suspension-System Members, Moldings, and Trim: Set of not less than 6 inch (150 mm) long Samples of each type, finish, and color.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension-system members.
2. Structural members to which suspension systems will be attached.
3. Method of attaching hangers to building structure.

    a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.

4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
5. Size and location of initial access modules for acoustical panels.
6. Items penetrating finished ceiling and ceiling-mounted items including, but not limited to, the following:

    a. Lighting fixtures.
    b. Diffusers.
    c. Grilles.
    d. Speakers.
    e. Sprinklers.
    f. Access panels.
    g. Perimeter moldings.

7. Show operation of hinged and sliding components covered by or adjacent to acoustical panels.
8. Minimum Drawing Scale: 1/8 inch = 1 foot (1:96).

B. Product Test Reports: For each acoustical panel ceiling, for tests performed by a qualified testing agency.

C. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size panels equal to 5 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to NVLAP for testing indicated.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

1.11 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace acoustical panels and suspension system components that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Acoustical panel failures include, but are not limited to, the following:

a. Visible sag, mold/mildew growth, and bacterial growth.

2. Suspension system component failures include, but are not limited to, the following:

a. Red rust.

3. Warranty Period: 30 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A according to ASTM E 1264.
2. Smoke-Developed Index: 50 or less.

2.3 REGULATORY REQUIREMENTS

A. Seismic Standard: Provide suspended ceilings and soffits designed and installed to withstand the effects of earthquake motions according to one of the following:

1. "Metal Suspension Systems For Lay-in Panel Ceilings: 2013 CBC": For grid suspension systems comply with State of California, Division of the State Architect, Interpretation of Regulations Document IR 25-2.13.

2.4 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Recycled Content of Steel Products: Recycled content not less than 20 percent.

C. Recycled Content of Acoustical Panels: Recycled content not less than 20 percent.

D. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.

E. Low-Emitting Materials: Acoustical panel ceilings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface according to ASTM E 795.

B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.6 ACOUSTICAL PANELS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc; Cirrus Second Look III, Scored Tegular, Medium Texture, Item Number 511, or a comparable product by one of the following:

1. CertainTeed Corporation.
2. Chicago Metallic Corporation.
3. United States Gypsum Company.

B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

C. Classification: Provide panels as follows:

1. Type and Form: Type III, mineral base with painted finish; Form 1, nodular.
2. Pattern: E (lightly textured), I (embossed), and K (surface scored).

D. Color: White.

E. Light Reflectance (LR): Not less than 0.85.

F. Ceiling Attenuation Class (CAC): Not less than 35.

G. Noise Reduction Coefficient (NRC): Not less than 0.65.

H. Edge/Joint Detail: Beveled tegular.

I. Thickness: 3/4 inch (19 mm).

J. Modular Size: 24 by 48 inches (610 by 1220 mm).

K. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.

2.7 METAL SUSPENSION SYSTEM

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc; Interlude XL Heavy-Duty 9/16 inch Exposed Dimensional Tee System, Heavy-Duty Main Beam Item Number 6061HRC, Heavy-Duty 48 inch Cross Tee Item Number XL6140HRC, or a comparable product by one of the following:

1. CertainTeed Corporation.
2. Chicago Metallic Corporation.
3. United States Gypsum Company.

B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M and designated by type, structural classification, and finish indicated.

C. Heavy-Duty, Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 (Z90) coating designation; with prefinished 9/16 inch (15 mm) wide metal caps on flanges.

1. Structural Classification: Heavy-duty system.
2. End Condition of Cross Runners: Override (stepped) type.
3. Face Design: Flanges formed with an integral center protrusion.
4. Cap Material: Cold-rolled steel.
5. Cap Finish: Painted white.

2.8 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488/E 488M or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

a. Type: Cast-in-place or postinstalled expansion anchors.
b. Corrosion Protection: Carbon-steel components zinc plated according to ASTM B 633, Class SC 1 (mild) service condition.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than wire size indicated in DSA IR 25-2.13.

C. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

D. Beam End Retaining Clips:

1. Fixed End: Subject to compliance with requirements, provide Armstrong World Industries; BERC, Beam End Retaining Clips, or a comparable product by another manufacturer. Clips shall be used to join main beams and cross tees to wall molding without the need for exposed fasteners.

a. Ceiling system may be attached to no more than two adjacent walls.

2. Free End: Subject to compliance with requirements, provide Armstrong World Industries; BERC2, 2 inch Beam End Retaining Clips, or a comparable product by another manufacturer. Clips shall be used to join main beams and cross tees to wall molding, allowing for seismic movement, without the need for stabilizer bars.

2.9 METAL EDGE MOLDINGS AND TRIM

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc; Interlude XL 9/16 inch Exposed Dimensional Tee System, Wall Molding Item Number 7800HRC, or a comparable product by one of the following:

1. CertainTeed Corporation.
2. Chicago Metallic Corporation.
3. United States Gypsum Company.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.10 ACOUSTICAL SEALANT

A. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C 636/C 636M, seismic design requirements, and manufacturer's written instructions.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.

4. Secure wire hangers to ceiling-suspension members and to supports above with not less than four tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts or postinstalled mechanical anchors that extend through forms into concrete.
6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
7. Do not attach hangers to steel deck tabs.
8. Do not attach hangers to steel roof deck unless otherwise indicated. Attach hangers to structural members.
9. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled mechanical anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install beam end retaining clips in accordance with manufacturer's instructions.

G. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.

1. Arrange directionally patterned acoustical panels as follows:

   a. As indicated on reflected ceiling plans.

2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m), non-cumulative.

B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m), non-cumulative.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Periodic inspection during the installation of suspended ceiling grids according to ASCE/SEI 7.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Perform the following tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages and when installation of ceiling suspension systems on each floor has reached 20 percent completion, but no panels have been installed. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations of acoustical panel ceiling hangers show compliance with requirements.

1. Within each test area, testing agency will select one of every 10 postinstalled mechanical anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select one of every two postinstalled mechanical anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) of tension.
2. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

D. Acoustical panel ceiling hangers, anchors, and fasteners will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.6 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

This page intentionally left blank.

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Thermoplastic-rubber base.
2. Rubber molding accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches (300 mm) long.

C. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive resilient products during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Finish Material Pollutant Control: Finish materials shall comply with CGBC Sections 5.504.4.1 through 5.504.4.6 per CGBC Section 5.504.4.

1. Adhesives, Sealants, and Caulks: Adhesives, sealants, and caulks used on the project shall meet the requirements of the following standards per CGBC Section 5.504.4.1:

    a. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in CBC Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products specified in subparagraph below.
    b. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

2. Adhesives shall comply with maximum VOC limits listed in CGBC Table 5.504.4.1.
3. Resilient Flooring Systems: For 80 percent of floor area receiving resilient flooring, installed resilient flooring shall meet at least one of the following per CGBC Section 5.504.4.6:

    a. Certified under the Resilient Floor Covering Institute (RFCI) FloorScore program.
    b. Compliant with the VOC-emission limits and testing requirements specified in the California Department of Public Health's 2010 Standard Method for the Testing and Evaluation Chambers, Version 1.1, February 2010.
    c. Compliant with the Collaborative for High Performance Schools California (CA-CHPS) Criteria Interpretation for EQ 7.0 and EQ 7.1 (formerly EQ 2.2) dated July 2012 and listed in the CHPS High Performance Product Database.
    d. Products certified under UL GREENGUARD Gold (formerly the Greenguard Children's and Schools Program).

C. VOC Content: Adhesives shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Rubber Floor Adhesives: 60 g/L.
2. VCT and Asphalt Tile Adhesives: 50 g/L.
3. Cove Base Adhesives: 50 g/L.

D. Low-Emitting Materials: Adhesives shall comply with the requirements of authorities having jurisdiction.

E. Low-Emitting Materials: Flooring systems shall comply with the requirements of authorities having jurisdiction.

2.2 THERMOPLASTIC-RUBBER BASE

A. Thermoplastic-Rubber Base:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Allstate Rubber Corp.
    b. Armstrong World Industries, Inc.
    c. Burke Mercer Flooring Products; a division of Burke Industries Inc.
    d. Flexco.
    e. Johnsonite; a Tarkett company.
    f. Nora Systems, Inc.
    g. Roppe Corporation, USA.
    h. VPI Corporation.

2. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic), Group I (solid, homogeneous).

    a. Style and Location:

        1) Style A, Straight: Provide in areas with carpet and carpet tile.
        2) Style B, Cove: Provide unless otherwise indicated.

3. Thickness: 0.125 inch (3.2 mm).
4. Height: 4 inches (102 mm) unless otherwise indicated.
5. Lengths: Cut lengths 48 inches (1219 mm) long or coils in manufacturer's standard length.
6. Outside Corners: Preformed.
7. Inside Corners: Job formed or preformed.
8. Colors: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

2.3 RUBBER MOLDING ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Roppe Corporation, USA.
2. VPI Corporation.

B. Description: Rubber nosing for carpet, nosing for resilient flooring, reducer strip for resilient flooring, joiner for resilient flooring and carpet, joiner for tile and carpet, and transition strips.

C. Profile and Dimensions: As indicated on Drawings.

D. Locations: Provide rubber molding accessories where two different types of flooring meet and are not separated by a threshold and where indicated on Drawings.

E. Colors and Patterns: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:

1. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.

    a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096543 - LINOLEUM FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Linoleum sheet flooring.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of linoleum flooring.

1. Include flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
2. Show details of special patterns.

C. Samples for Verification: For each type of linoleum flooring, in manufacturer's standard size, but not less than 6 by 9 inch (152 by 230 mm) sections of each different color and pattern required.

1. Heat-Welding Bead: Include manufacturer's standard-size Samples, but not less than 9 inches (230 mm) long, of each color required.

D. Heat-Welded Seam Samples: For each linoleum flooring product and welding bead color and pattern combination required; with seam running lengthwise and in center of 6 by 9 inch (152 by 230 mm) Sample applied to rigid backing and prepared by Installer for this Project.

E. Product Schedule: For linoleum flooring. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of linoleum flooring to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sheet Flooring: Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, in roll form and in full roll width for each type, color, and pattern of sheet flooring installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for flooring installation and seaming methods indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by flooring manufacturer for installation techniques required.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Coordinate mockups in this Section with mockups specified in other Sections.

a. Size: Not less than 100 sq. ft. (9.3 sq. m) for each type, color, and pattern in locations indicated on Drawings or, if not indicated, in locations directed by Architect.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 65 deg F (18 deg C) or more than 90 deg F (32 deg C).

1. Sheet Flooring: Store rolls upright.

1.9 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) and not more than 95 deg F (35 deg C), in spaces to receive flooring during the following periods:

1. 72 hours before installation.
2. During installation.
3. 72 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) and not more than 95 deg F (35 deg C).

C. Close spaces to traffic during flooring installation.

D. Close spaces to traffic for 72 hours after flooring installation.

E. Install flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 ACCESSIBILITY REQUIREMENTS

A. Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

B. Floor or Ground Surfaces:

1. General: Floor and ground surfaces shall be stable, firm, and slip resistant and shall comply with CBC Section 11B-302 per CBC Section 11B-302.1.

a. Exceptions:

1) Within animal containment areas, floor and ground surfaces shall not be required to be stable, firm, and slip resistant.
2) Areas of sport activity shall not be required to comply with CBC Section 11B-302.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For linoleum flooring, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.3 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Finish Material Pollutant Control: Finish materials shall comply with CGBC Sections 5.504.4.1 through 5.504.4.6 per CGBC Section 5.504.4.

1. Adhesives, Sealants, and Caulks: Adhesives, sealants, and caulks used on the project shall meet the requirements of the following standards per CGBC Section 5.504.4.1:

a. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in CBC Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products specified in subparagraph below.
b. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of

more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

2. Adhesives shall comply with maximum VOC limits listed in CGBC Table 5.504.4.1.
3. Resilient Flooring Systems: For 80 percent of floor area receiving resilient flooring, installed resilient flooring shall meet at least one of the following per CGBC Section 5.504.4.6:

   a. Certified under the Resilient Floor Covering Institute (RFCI) FloorScore program.
   b. Compliant with the VOC-emission limits and testing requirements specified in the California Department of Public Health's 2010 Standard Method for the Testing and Evaluation Chambers, Version 1.1, February 2010.
   c. Compliant with the Collaborative for High Performance Schools California (CA-CHPS) Criteria Interpretation for EQ 7.0 and EQ 7.1 (formerly EQ 2.2) dated July 2012 and listed in the CHPS High Performance Product Database.
   d. Products certified under UL GREENGUARD Gold (formerly the Greenguard Children's and Schools Program).

C. VOC Content: Adhesives shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Cove Base Adhesives: 50 g/L.
2. Other Adhesive Not Specifically Listed: 50 g/L.

D. Low-Emitting Materials: Adhesives shall comply with the requirements of authorities having jurisdiction.

E. Low-Emitting Materials: Flooring systems shall comply with the requirements of authorities having jurisdiction.

2.4 LINOLEUM SHEET FLOORING

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc; LinoArt Linoleum, or a comparable product by one of the following:

1. Forbo Industries, Inc.
2. Johnsonite; a Tarkett company.

B. Linoleum Sheet Flooring: ASTM F2034, Type I, linoleum sheet with backing.

1. Roll Size: In manufacturer's standard length, but not less than 78 inches (1980 mm) wide.

C. Thickness: Not less than 0.10 inch (2.5 mm).

D. Heat-Welding Bead: For seamless installation, solid-strand product of linoleum flooring manufacturer.

1. Colors: Match linoleum flooring.

E. Integral-Flash-Cove-Base Accessories:

1. Cove Strip: 1 inch (25.4 mm) radius, provided or approved by manufacturer.
2. Cove-Base Cap Strip: Square metal, vinyl, or rubber cap, provided or approved by manufacturer.

3. Corners: Metal inside and outside corners and end stops provided or approved by manufacturer.

F. Colors and Patterns: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

2.5 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by linoleum flooring manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit products and substrate conditions indicated.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by linoleum flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of flooring.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to linoleum flooring manufacturer's written instructions to ensure adhesion of flooring.

B. Concrete Substrates: Prepare according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by linoleum flooring manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by linoleum flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. (304.8 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have a moisture-vapor-emission rate of not more than 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a relative humidity level measurement not more than 75 percent.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install flooring until materials are the same temperature as space where they are to be installed.

1. At least 72 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by flooring.

3.3 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions for installing flooring.

B. Scribe and cut flooring to butt neatly and tightly to vertical surfaces and permanent fixtures, including built-in furniture, cabinets, pipes, outlets, edgings, thresholds, door frames, and nosings.

C. Extend flooring into toe spaces, door reveals, closets, and similar openings.

D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on flooring as marked on substrates. Use chalk or other nonpermanent marking device.

E. Install flooring on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.

F. Adhere flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

G. Heat-Welded Seams: For seamless installation, comply with ASTM F1516. Rout joints and heat weld with welding bead to fuse sections permanently into a seamless flooring installation. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.

3.4 LINOLEUM SHEET FLOORING INSTALLATION

A. Unroll linoleum sheet flooring and allow it to stabilize before cutting and fitting.

B. Lay out linoleum sheet flooring as follows:

1. Maintain uniformity of flooring direction.
2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, not less than 6 inches (152 mm) away from parallel joints in flooring substrates.
3. Match edges of flooring for color shading at seams.

4. Avoid cross seams.
5. Eliminate deformations that result from hanging method used during drying process (stove bar marks).

C. Integral-Flash-Cove Base: Cove flooring 6 inches (152 mm) up vertical surfaces unless otherwise indicated. Support flooring at horizontal and vertical junction with cove strip. Butt at top against cap strip.

1. Install metal corners at inside and outside corners.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting linoleum flooring.

B. Perform the following operations immediately after completing linoleum flooring installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect linoleum flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, adhesive, and blemishes from linoleum flooring surfaces before applying liquid floor polish.

1. Apply two coats.

E. After allowing drying room film (yellow film caused by linseed oil oxidation) to disappear, cover linoleum flooring until Substantial Completion.

END OF SECTION 096543

This page intentionally left blank.

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Modular carpet tile.

B. Related Requirements:

1. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:

a. Review delivery, storage, and handling procedures.
b. Review ambient conditions and ventilation procedures.
c. Review subfloor preparation procedures.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include manufacturer's written installation recommendations for each type of substrate.

B. Shop Drawings: For carpet tile installation, plans showing the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Carpet tile type, color, and dye lot.
3. Type of subfloor.
4. Type of installation.
5. Pattern of installation.

6. Pattern type, location, and direction.
7. Pile direction.
8. Type, color, and location of insets and borders.
9. Type, color, and location of edge, transition, and other accessory strips.
10. Transition details to other flooring materials.

C. Samples for Verification: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.
2. Exposed Edge, Transition, and Other Accessory Stripping: 12 inch (300 mm) long Samples.

D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockups for carpet tile.

a. Size: Not less than 100 sq. ft. (9.3 sq. m) for each type, color, and pattern in locations indicated on Drawings or, if not indicated, in locations directed by Architect.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Comply with the Carpet and Rug Institute's CRI 104.

1.10 FIELD CONDITIONS

A. Comply with the Carpet and Rug Institute's CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.11 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, the following:

a. More than 10 percent edge raveling, snags, and runs.
b. Dimensional instability.
c. Excess static discharge.
d. Loss of tuft-bind strength.
e. Loss of face fiber.
f. Delamination.

3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACCESSIBILITY REQUIREMENTS

A. Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

B. Carpet shall be stable, firm, and slip resistant and shall comply with CBC Section 11B-302 per CBC Section 11B-302.1.

C. Carpet shall be securely attached and shall have a firm cushion, pad, or backing or no cushion or pad. Carpet shall have a level loop, textured loop, level cut pile, or level cut/uncut pile texture. Pile height shall be 1/2 inch (12.7 mm) maximum. Exposed edges of carpet shall be fastened to floor surfaces and shall have trim on the entire length of the exposed edge. Carpet edge trim shall comply with CBC Section 11B-303 per CBC 11B-302.2.

2.2 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Finish Material Pollutant Control: Finish materials shall comply with CGBC Sections 5.504.4.1 through 5.504.4.6 per CGBC Section 5.504.4.

1. Adhesives, Sealants, and Caulks: Adhesives, sealants, and caulks used on the project shall meet the requirements of the following standards per CGBC Section 5.504.4.1:

    a. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in CBC Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products specified in subparagraph below.
    b. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

2. Adhesives shall comply with maximum VOC limits listed in CGBC Table 5.504.4.1.
3. Carpet Systems: All carpet installed in the building interior shall meet at least one of the following testing and product requirements per CGBC Section 5.504.4.4:

    a. Carpet and Rug Institute's Green Label Plus Program.
    b. Compliant with the VOC-emission limits and testing requirements specified in the California Department of Public Health Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1, February 2010 (also known as CPDH Standard Method V1.1 or Specification 01350).
    c. NSF/ANSI 140 at the Gold level or higher.
    d. Scientific Certifications Systems Sustainable Choice.
    e. Compliant with the California Collaborative for High Performance Schools (CA-CHPS) Criteria Interpretation for EQ 7.0 and EQ 7.1 (formerly EQ 2.2) dated July 2012 and listed in the CHPS High Performance Product Database.
    f. Carpet Cushion: All carpet cushion installed in the building interior shall meet the requirements of the Carpet and Rug Institute's Green Label program per CGBC Section 5.504.4.4.1.
    g. Carpet Adhesive: All carpet adhesive shall meet the requirements of CGBC Table 5.504.4.1.

C. VOC Content: Adhesives shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Indoor Carpet Adhesives: 50 g/L.
2. Carpet Pad Adhesives: 50 g/L.
3. Outdoor Carpet Adhesives: 150 g/L.

D. Low-Emitting Materials: Adhesives shall comply with the requirements of authorities having jurisdiction.

E. Low-Emitting Materials: Carpet systems shall comply with the requirements of authorities having jurisdiction.

2.3 CARPET TILE - Type 1

A. Basis-of-Design Product: Subject to compliance with requirements, provide Tandus; a Tarkett company; Iso #04536, Modular, Powerbond, or a comparable product by one of the following:

1. Atlas Carpet Mills, Inc.
2. Beaulieu Group LLC.
3. Bentley Prince Street, Inc.
4. Interface, LLC.
5. J&J Invision; J&J Industries, Inc.
6. Julie Industries.
7. Mannington Mills, Inc.
8. Milliken & Company.
9. Mohawk Group (The); Mohawk Carpet, LLC.
10. Patcraft; a division of Shaw Industries, Inc.
11. Philadelphia Commercial; a division of Shaw Industries, Inc.
12. Schönox, HPS North America, Inc.
13. Shaw Contract Group; a Berkshire Hathaway company.

B. Color: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

C. Pattern: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

D. Pile Characteristic: Level-loop, textured loop, level cut pile, or level cut/uncut pile texture.

E. Pile Thickness: Not more than 1/2 inch (12.7 mm) for finished carpet tile according to ASTM D6859.

F. Size: 18 by 18 inches (457 by 457 mm).

G. Applied Treatments:

1. Soil-Resistance Treatment: Manufacturer's standard treatment.
2. Antimicrobial Treatment: Manufacturer's standard treatment that protects carpet tiles as follows:

a. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.

H. Performance Characteristics:

1. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm according to NFPA 253.
2. Dimensional Tolerance: Within 1/32 inch (0.8 mm) of specified size dimensions, as determined by physical measurement.
3. Dimensional Stability: 0.2 percent or less according to ISO 2551 (Aachen Test).
4. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.

2.4 CARPET TILE – Type 2

A. Basis-of-Design Product: Subject to compliance with requirements, provide Tandus; a Tarkett company; Geo Tile #00979, Modular, or a comparable product by one of the following:

1. Atlas Carpet Mills, Inc.
2. Beaulieu Group LLC.
3. Bentley Prince Street, Inc.
4. Interface, LLC.
5. J&J Invision; J&J Industries, Inc.
6. Julie Industries.
7. Mannington Mills, Inc.
8. Milliken & Company.
9. Mohawk Group (The); Mohawk Carpet, LLC.
10. Patcraft; a division of Shaw Industries, Inc.
11. Philadelphia Commercial; a division of Shaw Industries, Inc.
12. Schönox, HPS North America, Inc.
13. Shaw Contract Group; a Berkshire Hathaway company.

B. Color: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

C. Pattern: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

D. Pile Characteristic: Level-loop, textured loop, level cut pile, or level cut/uncut pile texture.

E. Pile Thickness: Not more than 1/2 inch (12.7 mm) for finished carpet tile according to ASTM D6859.

F. Size: 18 by 18 inches (457 by 457 mm).

G. Applied Treatments:

1. Soil-Resistance Treatment: Manufacturer's standard treatment.
2. Antimicrobial Treatment: Manufacturer's standard treatment that protects carpet tiles as follows:

a. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.

H. Performance Characteristics:

1. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm according to NFPA 253.
2. Dimensional Tolerance: Within 1/32 inch (0.8 mm) of specified size dimensions, as determined by physical measurement.
3. Dimensional Stability: 0.2 percent or less according to ISO 2551 (Aachen Test).
4. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.

2.5 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.

B. Examine carpet tile for type, color, pattern, and potential defects.

C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.

1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. (304.8 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

   a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
   b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
   c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider, and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with the Carpet and Rug Institute's CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Maintain pile-direction patterns recommended in writing by carpet tile manufacturer.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with the Carpet and Rug Institute's CRI 104, Section 13.7.

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 097200 - WALL COVERINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Vinyl wall covering.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data on physical characteristics, durability, fade resistance, and fire-test-response characteristics.

B. Samples for Verification: For each type of wall covering and for each color, pattern, texture, and finish specified, full width by not less than 36 inch (914 mm) long in size.

C. Product Schedule: For wall coverings. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Product Test Reports: For each wall covering, for tests performed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For wall coverings to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Wall-Covering Materials: For each type, color, texture, and finish, full width by length to equal to 5 percent of amount installed.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at levels intended for occupants after Project completion during the remainder of the construction period.

B. Lighting: Do not install wall covering until lighting that matches conditions intended for occupants after Project completion is provided on the surfaces to receive wall covering.

C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates according to test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

2. Fire-Growth Contribution: No flashover and heat and smoke release according to NFPA 265 or NFPA 286.

2.2 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Finish Material Pollutant Control: Finish materials shall comply with CGBC Sections 5.504.4.1 through 5.504.4.6 per CGBC Section 5.504.4.

1. Adhesives, Sealants, and Caulks: Adhesives, sealants, and caulks used on the project shall meet the requirements of the following standards per CGBC Section 5.504.4.1:

a. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in CBC Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products specified in subparagraph below.
b. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

2. Adhesives shall comply with maximum VOC limits listed in CGBC Table 5.504.4.1.

C. VOC Content: Adhesives shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Other Adhesive Not Specifically listed: 50 g/L.

D. Low-Emitting Materials: Adhesives shall comply with the requirements of authorities having jurisdiction.

2.3 VINYL WALL COVERING

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Arc-Com.
2. Blue Mountain Wallcoverings.
3. Brewster Home Fashions.
4. D. L. Couch.
5. DesignTex Inc.
6. Eykon Design Resources.
7. F. Schumacher & Co.
8. Fidelity Wallcoverings Inc.
9. Gilford Inc.
10. Innovations.
11. Knoll, Inc.
12. Len-Tex Corporation.
13. MDC.
14. RJF International Corporation.
15. Roysons Corporation.
16. Source One Wallcovering.
17. U.S. Vinyl Wallcovering Corporation.
18. Versa; LSI Wallcovering.
19. Vescom America Inc.
20. Warner Wallcoverings; a division of RJF International Corporation.
21. Wolf-Gordon.
22. York Wallcoverings.

B. Description: Provide mildew-resistant products in rolls from same production run and complying with the following:

1. FS CCC-W-408D or CFFA-W-101-D for Type II, Medium-Duty products.
2. ASTM F 793 for strippable wall coverings.

    a. Category: V, Type II, Commercial Serviceability.

C. Repeat: Random.

D. Stain-Resistant Coating: Manufacturer's standard coating.

E. Colors, Textures, and Patterns: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

2.4 ACCESSORIES

A. Adhesive: Mildew-resistant, nonstaining, strippable adhesive, for use with specific wall covering and substrate application indicated and as recommended in writing by wall-covering manufacturer.

B. Primer/Sealer: Mildew resistant, complying with requirements in Section 099123 "Interior Painting" and recommended in writing by primer/sealer and wall-covering manufacturers for intended substrate.

C. Metal Primer: Interior ferrous metal primer complying with Section 099123 "Interior Painting" and recommended in writing by primer and wall-covering manufacturers for intended substrate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, mildew, and incompatible primers.

C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.

1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
2. Metals: If not factory primed, clean and apply primer recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
3. Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.

4. Painted Surfaces: Treat areas susceptible to pigment bleeding.

D. Check painted surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finish with fine sandpaper.

E. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

F. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.3 WALL-COVERING INSTALLATION

A. Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated.

B. Cut wall-covering strips in roll number sequence. Change the roll numbers at partition breaks and corners.

C. Install strips in same order as cut from roll.

1. For solid-color, even-texture, or random-match wall coverings, reverse every other strip.

D. Install wall covering without lifted or curling edges and without visible shrinkage.

E. Install seams vertical and plumb at least 6 inches (150 mm) from outside corners and 6 inches (150 mm) from inside corners unless a change of pattern or color exists at corner. Horizontal seams are not permitted.

F. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without overlaps or gaps between strips.

G. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

3.4 CLEANING

A. Remove excess adhesive at seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended in writing by wall-covering manufacturer.

C. Replace strips that cannot be cleaned.

D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 097200

This page intentionally left blank.

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes surface preparation and the application of paint systems on interior substrates.

1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.

1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Prefinished items include, but are not limited to, the following factory-finished components:

a. Architectural woodwork.
b. Acoustical wall panels.
c. Metal toilet enclosures.
d. Metal lockers.
e. Unit kitchens.
f. Elevator entrance doors and frames.
g. Elevator equipment.
h. Finished mechanical and electrical equipment.
i. Light fixtures.

2. Concealed surfaces include, but are not limited to, walls or ceilings in the following generally inaccessible spaces:

a. Foundation spaces.
b. Furred areas.
c. Ceiling plenums.
d. Utility tunnels.
e. Pipe spaces.
f. Duct shafts.

g. Elevator shafts.

3. Finished metal surfaces include, but are not limited to, the following:

a. Anodized aluminum.
b. Stainless steel.
c. Chromium plate.
d. Copper and copper alloys.
e. Bronze and brass.

4. Operating parts include, but are not limited to, moving parts of operating equipment and the following:

a. Valve and damper operators.
b. Linkages.
c. Sensing devices.
d. Motor and fan shafts.

5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Requirements:

1. Section 051200 "Structural Steel Framing" for shop priming of metal substrates.
2. Section 055000 "Metal Fabrications" for shop priming metal fabrications.
3. Section 055113 "Metal Pan Stairs" for shop priming metal pan stairs.
4. Section 055213 "Pipe and Tube Railings" for shop priming pipe and tube railings.
5. Section 099600.10 "High-Performance Coatings - Metal" for special-use coatings on metal substrates.

1.3 DEFINITIONS

A. Flat: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. Velvet: 5 to 10 units at 60 degrees and 10 to 15 units at 85 degrees, according to ASTM D 523.

C. Eggshell: 10 to 15 units at 60 degrees and 15 to 30 units at 85 degrees, according to ASTM D 523.

D. Low-Luster (Low-Sheen): 20 to 25 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

E. Semigloss: 35 to 70 units at 60 degrees, according to ASTM D 523.

F. Full Gloss (Gloss): More than 75 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

a) VOC Content: Include VOC content for each product.

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8-1/2 by 11 inches (216 by 279 mm).
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product List: An inclusive list of required coating products. Indicate each product and cross-reference specific coating, finish system, and application. Identify each product by manufacturer's catalog number and general classification. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

a. Provide extra materials in unopened 1 gal. (3.8 L) containers.

1.6 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

1.7 MOCKUPS

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:

1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. VOC content.

B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.
3. Store on shelves or wood pallets.

1.9 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers Names: Shortened versions (shown in parentheses) of the following manufacturers names are used in other Part 2 articles:

1. Behr Process Corporation (Behr).
2. Dunn-Edwards Corporation (Dunn-Edwards).
3. PPG Paints (PPG)
4. Sherwin-Williams Company (The) (Sherwin-Williams).
5. Vista Paint (Vista).

B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles for the paint category indicated.

C. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

2.2 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Finish Material Pollutant Control: Finish materials shall comply with CGBC Sections 5.504.4.1 through 5.504.4.6 per CGBC Section 5.504.4.

1. Paints and Coatings: Architectural paints and coatings shall comply with VOC limits in Table 1 of the ARB Architectural Coatings Suggested Control Measure, as shown in CGBC Table 5.504.4.3, unless more stringent local limits apply. The VOC content limit for coatings that do not meet the definitions for the specialty coatings categories listed in CGBC Table 5.504.4.3 shall be determined by classifying the coating as a Flat, Nonflat, or Nonflat-High Gloss coating, based on its gloss, as defined in Subsections 4.21, 4.36, and 4.37 of the 2007 California Air Resources Board Suggested Control Measure, and the corresponding Flat, Nonflat, or Nonflat-High Gloss VOC limit in CGBC Table 5.504.4.3 shall apply per CGBC Section 5.504.4.3.

C. VOC Content: Paints and coatings applied at Project site, shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Flat Coatings: 50 g/L.
2. Nonflat Coatings: 100 g/L.
3. Nonflat High Gloss Coatings: 150 g/L.
4. Dry-Fog Coatings: 150 g/L.
5. Faux Finishing Coatings: 350 g/L.
6. Floor Coatings: 100 g/L.
7. Graphic Arts Coatings (Sign Paints): 500 g/L.
8. High Temperature Coatings: 420 g/L.
9. Industrial Maintenance Coatings: 250 g/L.
10. Low Solids Coatings: 120 g/L.
11. Pretreatment Wash Primers: 420 g/L.
12. Metallic Pigmented Coatings: 500 g/L.
13. Multicolor Coatings: 250 g/L.
14. Pretreatment Wash Primers: 420 g/L.
15. Primers, Sealers, and Undercoaters: 100 g/L.
16. Reactive Penetrating Sealers: 350 g/L.
17. Recycled Coatings: 250 g/L.
18. Rust Preventative Coatings: 250 g/L.
19. Shellacs, Clear: 730 g/L.
20. Shellacs, Opaque: 550 g/L.
21. Specialty Primers, Sealers, and Undercoaters: 100 g/L.
22. Wood Coatings: 275 g/L.
23. Zinc-Rich Primers: 340 g/L.

D. Low-Emitting Materials: Paints and coatings shall comply with the requirements of authorities having jurisdiction.

2.3 PAINT, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. Material Quality:

1. Provide paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
2. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. Colors: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

2.4 PRETREATMENT FOR GALVANIZED METAL

A. Interior Zinc-Coated Metal Pretreatment: Factory-formulated galvanized metal pretreatment for exterior and interior application.

1. Behr: Krud Kutter; Metal Clean & Etch.
2. Dunn-Edwards: Supreme Chemical; Metal Clean and Etch (SCME01).
3. PPG: Duraprep Concentrated Multi-Purpose Cleaner Prep120.
4. Sherwin-Williams: DTM Wash Primer B71Y1.
5. Vista: Krud Kutter; Metal Clean & Etch.

2.5 PRIMERS/SEALERS

A. Interior Gypsum Board Primer: Factory-formulated latex-based primer for interior application.

1. Behr: Premium Plus Interior Drywall Primer Sealer (73): Applied at a dry film thickness of not less than 1.4 mils (0.0356 mm).
2. Dunn-Edwards: VINYLASTIC Premium (VNPR00): Applied at a dry film thickness of not less than 2.0 mils (0.0508 mm).
3. PPG: Speedhide Interior Max Prime Latex Primer Surfacer 6-4: Applied at a dry film thickness of not less than 1.0 mils (0.0254 mm).
4. Sherwin-Williams: ProMar 200 Zero Interior Latex Primer, B28W8600: Applied at a dry film thickness of not less than 1.5 mils (0.0381 mm).
5. Vista: 5001V Pro 5000 Primer: Applied at a dry film thickness of not less than 1.2 mils (0.0305 mm).

2.6 METAL PRIMERS

A. Interior Ferrous-Metal Primer: Factory-formulated quick-drying rust-inhibitive metal primer.

1. Behr: Premium Plus Interior / Exterior Multi-Surface Primer & Sealer (436): Applied at a dry film thickness of not less than 1.8 mils (0.0457 mm).

2. Dunn-Edwards: BLOC-RUST Premium (BRPR00): Applied at a dry film thickness of not less than 2.0 mils (0.0508 mm).
3. PPG: Pitt-Tech Plus DTM Industrial Primer 4020: Applied at a dry film thickness between 2.0 and 4.0 mils (0.0508 and 0.1016 mm).
4. Sherwin-Williams: Pro Industrial Pro-Cryl Universal Primer, B66-310 Series: Applied at a dry film thickness between 2.0 and 4.0 mils (0.0508 and 0.1016 mm).
5. Vista: 9600 Protec Metal Prime: Applied at a dry film thickness of not less than 2.0 mils (0.0508 mm).

B. Interior Zinc-Coated Metal Primer: Factory-formulated galvanized metal primer.

1. Behr: Premium Plus Interior / Exterior Multi-Surface Primer & Sealer (436): Applied at a dry film thickness of not less than 1.8 mils (0.0457 mm).
2. Dunn-Edwards: Provide one of the following:

    a. ULTRASHIELD Galvanized Metal Primer (ULGM00): Applied at a dry film thickness of not less than 2.0 mils (0.0508 mm).
    b. ULTRA-GRIP Premium Interior/Exterior Multi-Surface Primer UGPR00: Applied at a dry film thickness of not less than 2.0 mils (0.0508 mm).

3. PPG: Pitt-Tech Plus DTM Industrial Primer 4020: Applied at a dry film thickness between 2.0 and 4.0 mils (0.0508 and 0.1016 mm).
4. Sherwin-Williams: Pro Industrial Pro-Cryl Universal Primer, B66-310 Series: Applied at a dry film thickness between 2.0 and 4.0 mils (0.0508 and 0.1016 mm).
5. Vista: 4800 Metal Pro Primer: Applied at a dry film thickness between 1.2 and 2.5 mils (0.0305 and 0.0635 mm).

2.7 WOOD PRIMERS

A. Interior Wood Primer for Acrylic-Enamel Finishes: Factory-formulated acrylic-latex-based interior wood primer.

1. Behr: Premium Plus All-In-One Primer Sealer (75): Applied at a dry film thickness of not less than 1.6 mils (0.0406 mm).
2. Dunn-Edwards: Provide one of the following:

    a. INTER-KOTE (IKPR00): Applied at a dry film thickness of not less than 1.5 mils (0.0381 mm).
    b. EZ Prime (EZPR00); Applied at a dry film thickness of not less than 2.0 mils (0.0508 mm).

3. PPG: Seal Grip Acrylic Universal Primer/Sealer 17-921: Applied at a dry film thickness of not less than 1.6 mils (0.0406 mm).
4. Sherwin-Williams: Premium Wall & Wood Primer, B28W8111: Applied at a dry film thickness of not less than 1.4 mils (0.0356 mm).
5. Vista: 4200 Terminator II Acrylic Primer Sealer: Applied at a dry film thickness of not less than 1.9 mils (0.0483 mm).

2.8 WATER-BASED PAINTS

A. Interior Flat Acrylic Paint: Factory-formulated flat acrylic-emulsion latex paint for interior application. Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

1. Behr: Premium Plus Interior Flat (1050): Applied at a dry film thickness of not less than 1.6 mils (0.0406 mm).
2. Dunn-Edwards: SPARTAWALL Interior Flat Paint (SWLL10): Applied at a dry film thickness of
3. PPG: Speedhide Interior Flat Latex 6-70: Applied at a dry film thickness of not less than 1.3 mils (0.0330 mm).
4. Sherwin-Williams: ProMar 200 Zero Flat, B30-2600 Series: Applied at a dry film thickness of not less than 1.6 mils (0.0406 mm).
5. Vista: 1000 Duraglide Flat Finish: Applied at a dry film thickness of not less than 1.6 mils (0.0406 mm).

B. Interior Low-Luster (Low-Sheen) Acrylic Enamel: Factory-formulated low-luster (low-sheen) acrylic-latex interior enamel. 20 to 25 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

1. Behr: Premium Plus Interior Satin Enamel (7050): Applied at a dry film thickness of not less than 1.4 mils (0.0356 mm).
2. Dunn-Edwards: SPARTAWALL Interior Low Sheen Paint (SWLL40): Applied at a dry film thickness of not less than 1.5 mils (0.0381 mm).
3. PPG: Ultra Hide 150 #1433 Interior Latex Low Luster: Applied at a dry film thickness of not less than 1.3 mils (0.0330 mm).
4. Sherwin-Williams: ProMar 200 Zero VOC Low Sheen, B24-2600 Series: Applied at a dry film thickness of not less than 1.6 mils (0.0406 mm).
5. Vista: 1750 Acriglo Velvasheen: Applied at a dry film thickness of not less than 1.2 mils (0.0305 mm).

C. Interior Semigloss Acrylic Enamel: Factory-formulated semigloss acrylic-latex enamel for interior application. 35 to 70 units at 60 degrees, according to ASTM D 523.

1. Behr: Premium Plus Interior Semi-Gloss Enamel (3050): Applied at a dry film thickness of not less than 1.4 mils (0.0356 mm).
2. Dunn-Edwards: SPARTAWALL Interior Semi-Gloss Paint (SWLL50): Applied at a dry film thickness of not less than 1.5 mils (0.0381 mm).
3. PPG: Speedhide Interior Zero VOC Semi-Gloss Latex 6-4510XI: Applied at a dry film thickness of not less than 1.4 mils (0.0356 mm).
4. Sherwin-Williams: ProMar 200 Zero VOC Semi-Gloss, B31-2600 Series: Applied at a dry film thickness of not less than 1.6 mils (0.0406 mm).
5. Vista: 5400 V-PRO 5000 Semi-Gloss: Applied at a dry film thickness of not less than 1.8 mils (0.0457 mm).

2.9 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Wood: 15 percent.
2. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

F. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.

B. Remove door and other hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:

1. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Aluminum Substrates: Remove loose surface oxidation.

J. Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
3. Paint faces, all four edges, edges of cutouts, and mortises of exterior doors and entire exposed surface of exterior door frames.

a. Paint all surfaces that will be covered by door hardware including, but not limited to, kick, mop, and armor protection plates.

4. Paint entire exposed surface of window frames and sashes.
5. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
6. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
7. Primers specified in painting schedules are required on items that are factory primed or factory finished.

B. Tint undercoats same color as topcoat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:

a. Equipment, including panelboards and switch gear.
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.
g. Tanks that do not have factory-applied final finishes.
h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.

2. Paint the following work where exposed in occupied spaces:

a. Equipment, including panelboards.
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.
g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
h. Other items as directed by Architect.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:

1. Flat Acrylic Finish: Two finish coats over a primer.

   a. Primer: Interior gypsum board primer.
   b. Finish Coats: Interior flat acrylic paint.

2. Low-Luster (Low-Sheen) Acrylic-Enamel Finish: Two finish coats over a primer.

   a. Primer: Interior gypsum board primer.
   b. Finish Coats: Interior low-luster (low-sheen) acrylic enamel.

3. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.

   a. Primer: Interior gypsum board primer.
   b. Finish Coats: Interior semigloss acrylic enamel.

B. Wood, Plywood, and Hardboard: Provide the following paint finish systems over new interior wood surfaces:

1. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.

   a. Primer: Interior wood primer for acrylic-enamel finishes.
   b. Finish Coats: Interior semigloss acrylic enamel.

C. Ferrous Metal: Provide the following finish systems over ferrous metal:

1. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.

   a. Primer: Interior ferrous-metal primer.
   b. Finish Coats: Interior semigloss acrylic enamel.

D. Zinc-Coated Metal: Provide the following finish systems over interior zinc-coated metal surfaces:

1. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.

   a. Pretreatment: Interior zinc-coated metal pretreatment. Required even if not recommended.
   b. Primer: Interior zinc-coated metal primer.
   c. Finish Coats: Interior semigloss acrylic enamel.

END OF SECTION 099123

SECTION 099600.10 - HIGH-PERFORMANCE COATINGS - METAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes surface preparation and the application of high-performance coating systems.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for shop priming metal fabrications with primers specified in this Section.
2. Section 055113 "Metal Pan Stairs" for shop priming metal pan stairs with primers specified in this Section.
3. Section 055213 "Pipe and Tube Railings" for shop priming pipe and tube railings with coatings specified in this Section.
4. Section 099123 "Interior Painting" for general field painting.

1.3 DEFINITIONS

A. Flat: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. Velvet: 5 to 10 units at 60 degrees and 10 to 15 units at 85 degrees, according to ASTM D 523.

C. Eggshell: 10 to 15 units at 60 degrees and 15 to 30 units at 85 degrees, according to ASTM D 523.

D. Low-Luster (Low-Sheen): 20 to 25 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

E. Semigloss: 35 to 70 units at 60 degrees, according to ASTM D 523.

F. Full Gloss (Gloss): More than 75 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

a. VOC Content: Include VOC content for each product.

B. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.

1. Submit Samples on rigid backing, 8-1/2 by 11 inches (216 by 279mm).
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product List: Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Applicator.

1.6 CLOSEOUT SUBMITTALS

A. Coating Maintenance Manual: Upon conclusion of the project, the Applicator, paint manufacturer, or paint supplier shall furnish a coating maintenance manual, such as Sherwin-Williams "Custodian Project Color and Product Information" or equal. Manual shall include:

1. Area summary with finish schedule.
2. Area detail designating where each product / color / finish was used.
3. Product data pages for each product used.
4. Material Safety Data Sheets (MSDS) for each product used.
5. Care and cleaning instructions.
6. Touch-up procedures.
7. Samples of each color and finish used.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

a. Provide extra materials in unopened 1 gal. (3.8 L) containers.

1.8 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

1.9 MOCKUPS

A. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each coating system.

    a. Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

    a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:

1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. VOC content.

B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.
3. Store on shelves or wood pallets.

1.11 FIELD CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

C. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Products: Subject to compliance with requirements, provide products indicated or comparable products by another manufacturer.

B. Source Limitations: Obtain primers and intermediate coats for each coating system from the same manufacturer as the finish coats.

2.2 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Finish Material Pollutant Control: Finish materials shall comply with CGBC Sections 5.504.4.1 through 5.504.4.6 per CGBC Section 5.504.4.

1. Paints and Coatings: Architectural paints and coatings shall comply with VOC limits in Table 1 of the ARB Architectural Coatings Suggested Control Measure, as shown in CGBC Table 5.504.4.3, unless more stringent local limits apply. The VOC content limit for coatings that do not meet the definitions for the specialty coatings categories listed in CGBC Table 5.504.4.3 shall be determined by classifying the coating as a Flat, Nonflat, or Nonflat-High Gloss coating, based on its gloss, as defined in Subsections 4.21, 4.36, and 4.37 of the 2007 California Air Resources Board Suggested Control Measure, and the corresponding Flat, Nonflat, or Nonflat-High Gloss VOC limit in CGBC Table 5.504.4.3 shall apply per CGBC Section 5.504.4.3.

C. VOC Content: Paints and coatings applied at Project site, shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Flat Coatings: 50 g/L.
2. Nonflat Coatings: 100 g/L.
3. Nonflat High Gloss Coatings: 150 g/L.
4. Dry-Fog Coatings: 150 g/L.
5. Faux Finishing Coatings: 350 g/L.
6. Floor Coatings: 100 g/L.
7. Graphic Arts Coatings (Sign Paints): 500 g/L.
8. High Temperature Coatings: 420 g/L.
9. Industrial Maintenance Coatings: 250 g/L.
10. Low Solids Coatings: 120 g/L.
11. Pretreatment Wash Primers: 420 g/L.
12. Metallic Pigmented Coatings: 500 g/L.
13. Multicolor Coatings: 250 g/L.
14. Pretreatment Wash Primers: 420 g/L.
15. Primers, Sealers, and Undercoaters: 100 g/L.
16. Reactive Penetrating Sealers: 350 g/L.
17. Recycled Coatings: 250 g/L.
18. Rust Preventative Coatings: 250 g/L.
19. Shellacs, Clear: 730 g/L.
20. Shellacs, Opaque: 550 g/L.
21. Specialty Primers, Sealers, and Undercoaters: 100 g/L.

22. Wood Coatings: 275 g/L.
23. Zinc-Rich Primers: 340 g/L.

D. Low-Emitting Materials: Paints and coatings shall comply with the requirements of authorities having jurisdiction.

2.3 HIGH-PERFORMANCE COATINGS, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
3. Products shall be of same manufacturer for each coat in a coating system.

B. Colors: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

2.4 METAL PRIMERS

A. Primer, Zinc-Rich, Epoxy:

1. Basis-of-Design Product: Tnemec Company, Inc.; Series 94-H2O Hydro-Zinc: Applied at a dry film thickness between 2.5 and 3.5 mils (0.0635 and 0.0889 mm).

B. Spot Primer, Zinc-Rich, Epoxy:

1. Basis-of-Design Product: Tnemec Company, Inc.; Series 94-H2O Hydro-Zinc: Applied at a dry film thickness between 2.5 and 3.5 mils (0.0635 and 0.0889 mm).

2.5 EPOXY INTERMEDIATE COATS

A. Epoxy Intermediate Coat:

1. Basis-of-Design Product: Tnemec Company, Inc.; Series L69 High-Build Epoxoline II: Applied at a dry film thickness between 4.0 and 6.0 mils (0.1016 and 0.1524 mm).

2.6 FINISH COATS

A. Metallic Fluoropolymer, Semigloss:

1. Basis-of-Design Product: Tnemec Company, Inc.; Series 1078V Fluoronar Metallic: Applied at a dry film thickness between 2.0 and 3.0 mils (0.0508 and 0.0762 mm).

2.7 SOURCE QUALITY CONTROL

A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If coating materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

C. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations applicable to substrates and coating systems indicated.

B. Remove door and other hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Do not remove zinc-rich primer unless otherwise indicated. Clean using methods recommended in writing by paint manufacturer but not less than the following:

1. Field: SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
2. Shop: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

1. SSPC-SP 11, "Power Tool Cleaning to Bare Metal" all welds and damaged Zinc-Rich primer.

F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

1. SSPC-SP 1, "Solvent Cleaning" to remove all soluble contamination. Thoroughly roughen the entire surface to be coated using compressed air nozzle brush off blast cleaning with a fine abrasive to achieve a uniform anchor profile of 1.0 to 2.0 mils (0.0254 to 0.0508 mm). Reference ASTM D6386, Section 5.4.1.

3.3 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and recommendations applicable to substrates and coating systems indicated.

1. Use applicators and techniques suited for coating and substrate indicated.
2. Coat surfaces behind movable items same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint faces, all four edges, edges of cutouts, and mortises of exterior doors and entire exposed surface of exterior door frames.

    a. Paint all surfaces that will be covered by door hardware including, but not limited to, kick, mop, and armor protection plates.

4. Coat front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
5. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Tint undercoats to match color of finish coat.

C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.

D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.

1. Contractor shall touch up and restore coated surfaces damaged by testing.
2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.6 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Steel Substrates:

1. Semigloss Metallic Fluoropolymer System: Finish coat over an intermediate coat over a primer.

a. Prime Coat: Zinc-rich, epoxy.
b. Intermediate Coat: Epoxy.
c. Topcoat: Metallic Fluoropolymer.

B. Galvanized-Metal Substrates:

1. Semigloss Metallic Fluoropolymer System: Finish coat over an intermediate coat over a primer.

a. Prime Coat: Zinc-rich, epoxy.
b. Intermediate Coat: Epoxy.
c. Topcoat: Metallic Fluoropolymer.

3.7 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Steel Substrates:

1. Semigloss Metallic Fluoropolymer System: Finish coat over an intermediate coat over a primer.

a. Prime Coat: Zinc-rich, epoxy.

b. Intermediate Coat: Epoxy.
c. Topcoat: Metallic Fluoropolymer.

B. Galvanized-Metal Substrates:

1. Semigloss Metallic Fluoropolymer System: Finish coat over an intermediate coat over a primer.

a. Prime Coat: Zinc-rich, epoxy.
b. Intermediate Coat: Epoxy.
c. Topcoat: Metallic Fluoropolymer.

END OF SECTION 099600.10

This page intentionally left blank.

SECTION 101100 - VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Visual display board assemblies.

B. Related Requirements:

1. Section 092216 "Non-Structural Metal Framing" for metal backing for anchoring visual display units.
2. Section 101200 "Display Cases" for individually framed and enclosed, wall-mounted bulletin boards and for tackboards within display cases.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.

B. Shop Drawings: For visual display units.

1. Include plans, elevations, sections, details, and attachment to other work.
2. Show locations of panel joints. Show locations of field-assembled joints for factory-fabricated units too large to ship in one piece.
3. Include sections of typical trim members.

C. Samples for Verification: For each type of visual display unit indicated.

1. Visual Display Panel: Not less than 8-1/2 by 11 inches (215 by 280 mm), with facing, core, and backing indicated for final Work. Include one panel for each type, color, and texture required.
2. Trim: 6 inch (150 mm) long sections of each trim profile.
3. Accessories: Full-size Sample of each type of accessory.

D. Product Schedule: For visual display units. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Seismic Qualification Certificates: For visual display units, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Product Test Reports: For tackboard panels, for tests performed by a qualified testing agency, for surface-burning characteristics of tackboard panels.

D. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For visual display units to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

B. Store visual display surfaces vertically with packing materials between each unit.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.10 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Surfaces lose original writing and erasing qualities.
b. Surfaces exhibit crazing, cracking, or flaking.

2. Warranty Period: Life of the building.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of visual display unit from single source from single manufacturer.

2.2 ACCESSIBILITY REQUIREMENTS

A. Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

B. Reach Ranges:

1. General: Reach ranges shall comply with CBC Section 11B-308 per CBC Section 11B-308.1.

2.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Visual display units shall withstand the effects of earthquake motions according to ASCE/SEI 7.

1. Component Importance Factor is 1.0.

B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

2.4 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Recycled Content of Particleboard: Recycled content not less than 20 percent.

C. Recycled Content of Medium-Density Fiberboard: Recycled content not less than 20 percent.

D. Particleboard:

1. Composite Wood Products: Hardwood plywood, particleboard and medium density fiberboard composite wood products used on the interior or exterior of the building shall meet the requirements for formaldehyde as specified in California Air Resources Board's (CARB) Air Toxics Control Measure (ATCM) for Composite Wood (17 CCR 93120 et seq.) per CGBC Section 5.504.4.5. Those materials not exempted under ATCM must meet the specified emission limits, as shown in CGBC Table 5.504.4.5.
2. Composite Wood Products: Products shall be made without urea formaldehyde.
3. Formaldehyde emissions shall not exceed 0.09 ppm per CGBC Table 5.504.4.5.

E. Medium-Density Fiberboard:

1. Composite Wood Products: Hardwood plywood, particleboard and medium density fiberboard composite wood products used on the interior or exterior of the building shall meet the requirements for formaldehyde as specified in California Air Resources Board's (CARB) Air Toxics Control Measure (ATCM) for Composite Wood (17 CCR 93120 et seq.) per CGBC Section 5.504.4.5. Those materials not exempted under ATCM must meet the specified emission limits, as shown in CGBC Table 5.504.4.5.
2. Composite Wood Products: Products shall be made without urea formaldehyde.
3. Formaldehyde emissions shall not exceed 0.11 ppm per CGBC Table 5.504.4.5.

F. Finish Material Pollutant Control: Finish materials shall comply with CGBC Sections 5.504.4.1 through 5.504.4.6 per CGBC Section 5.504.4.

1. Adhesives, Sealants, and Caulks: Adhesives, sealants, and caulks used on the project shall meet the requirements of the following standards per CGBC Section 5.504.4.1:

   a. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in CBC Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products specified in subparagraph below.
   b. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

2. Adhesives shall comply with maximum VOC limits listed in CGBC Table 5.504.4.1.

G. Low-Emitting Materials: Adhesives shall comply with the requirements of authorities having jurisdiction.

2.5 MARKERBOARD ASSEMBLY

A. Basis-of-Design Product: Subject to compliance with requirements, provide Epson; 100 inch Whiteboard for Projection and Dry-erase, or comparable product by one of the following:

1. A-1 Visual Systems.
2. AARCO Products, Inc.

3. ADP Lemco.
4. AJW Architectural Products.
5. Architectural School Products Ltd.
6. Aywon.
7. Bangor Cork Company, Inc.
8. CIG-JAN Products, Ltd.
9. Claridge Products and Equipment, Inc.
10. Delta Products, Ltd.
11. Egan Visual Inc.
12. Everase, Inc.
13. EverWhite.
14. Ghent Manufacturing, Inc.
15. K-Pro Specialty Products.
16. Marsh Industries, Inc.
17. MooreCo, Inc.
18. Nudo Products, Inc.
19. Panel Processing, Inc.
20. Peter Pepper Products, Inc.
21. Platinum Visual Systems.
22. PolyVision Corporation.
23. Shanahan's Manufacturing Limited.

B. Visual Display Board Assembly: Factory fabricated.

1. Assembly: Markerboard and tackboard.
2. Corners: Square.
3. Width: 86.6 inches (2200 mm).
4. Height: 54.6 inches (1387 mm).
5. Mounting Method: Direct to wall.

C. Markerboard Panel: Porcelain-enamel-faced markerboard panel on core indicated.

1. Color: White.

D. Aluminum Frames and Trim: Fabricated from not less than 0.062 inch (1.57 mm) thick, extruded aluminum; standard size and shape.

1. Aluminum Finish: Clear anodic finish.

E. Joints: Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.

2.6 TACKBOARD ASSEMBLY

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. A-1 Visual Systems.
2. AARCO Products, Inc.
3. ADP Lemco.
4. AJW Architectural Products.

5. Architectural School Products Ltd.
6. Aywon.
7. Bangor Cork Company, Inc.
8. CIG-JAN Products, Ltd.
9. Claridge Products and Equipment, Inc.
10. Delta Products, Ltd.
11. Egan Visual Inc.
12. Everase, Inc.
13. EverWhite.
14. Ghent Manufacturing, Inc.
15. K-Pro Specialty Products.
16. Marsh Industries, Inc.
17. MooreCo, Inc.
18. Nudo Products, Inc.
19. Panel Processing, Inc.
20. Peter Pepper Products, Inc.
21. Platinum Visual Systems.
22. PolyVision Corporation.
23. Shanahan's Manufacturing Limited.

B. Visual Display Board Assembly: Factory fabricated.

1. Assembly: Tackboard.
2. Corners: Square.
3. Width: As indicated on Drawings.
4. Height: As indicated on Drawings.
5. Mounting Method: Direct to wall.

C. Tackboard Panel: Natural-cork tackboard panel on core indicated.

D. Aluminum Frames and Trim: Fabricated from not less than 0.062 inch (1.57 mm) thick, extruded aluminum; standard size and shape.

1. Aluminum Finish: Clear anodic finish.

E. Joints: Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.

2.7 MARKERBOARD PANELS

A. Porcelain-Enamel Markerboard Panels: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction, consisting of moisture-barrier backing, core material, and porcelain-enamel face sheet with low-gloss finish. Laminate panels under heat and pressure with manufacturer's standard, flexible waterproof adhesive.

1. Particleboard Core: 1/2 inch (13 mm) thick; with 0.005 inch (0.127 mm) thick, aluminum foil backing.
2. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.

2.8 TACKBOARD PANELS

A. Tackboard Panels:

1. Facing: 1/4 inch (6 mm) thick, natural cork.
2. Core: 1/4 inch (6 mm) thick particleboard.

2.9 MATERIALS

A. Porcelain-Enamel Face Sheet: PEI-1002, with face sheet manufacturer's standard two- or three-coat process.

B. Natural-Cork Sheet: Seamless, single-layer, compressed fine-grain cork sheet; bulletin board quality; face sanded for natural finish; with surface-burning characteristics indicated.

C. Particleboard: ANSI A208.1, Grade M-1, made with binder containing no urea formaldehyde.

D. Extruded Aluminum: ASTM B221 (ASTM B221M), Alloy 6063.

E. Fasteners: Provide screws, bolts, and other fastening devices made from stainless-steel unless otherwise indicated. Provide types, sizes, and lengths to suit installation conditions. Use security fasteners where exposed to view.

F. Adhesives for Field Application: Mildew-resistant, nonstaining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application; as recommended in writing by visual display unit manufacturer.

2.10 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.11 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

B. Examine walls and partitions for proper preparation and backing for visual display units.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.

C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.

3.3 INSTALLATION

A. General: Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design for accessible visual display unit mounting height. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

1. Provide continuous backing at top and bottom of boards.
2. No plastic anchors allowed.

B. Factory-Fabricated Visual Display Board Assemblies: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than 16 inches (400 mm) o.c. Secure tops and bottoms of boards to walls.

C. Visual Display Board Assembly Mounting Heights: Install visual display units at mounting heights indicated on Drawings, or if not indicated, at heights indicated below.

1. Mounting Height: 36 inches (914 mm) above finished floor to top of chalktray.

3.4 CLEANING AND PROTECTION

A. Clean visual display units in accordance with manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display units after installation and cleaning.

END OF SECTION 101100

SECTION 101200 - DISPLAY CASES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bulletin boards.

B. Related Requirements:

1. Section 092216 "Non-Structural Metal Framing" for metal backing for anchoring display cases.
2. Section 101100 "Visual Display Units" for tackboards.

1.3 DEFINITIONS

A. Bulletin Board: Glazed cabinet with tackboard panel, without shelves, typically of shallow depth for display of paper documents.

B. Display Case: Glazed cabinet with tackboard panel back surface and adjustable shelves.

C. Tackboard Panel: A material for holding push-pins or tacks, typically consisting of a facing such as fabric, vinyl, or cork; adhered to a substrate such as fiberboard, hardboard, or particleboard.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for bulletin boards. Include furnished specialties and accessories.

B. Shop Drawings: For bulletin boards.

1. Include plans, elevations, sections, and attachment details.
2. Show location of seams and joints in tackboard panels.

3. Include sections of typical trim members.

C. Samples for Verification: For each type of exposed finish for the following.

1. Tackboard Panel: Not less than 8-1/2 by 11 inches (215 by 280 mm), with facing and substrate indicated for final Work. Include one panel for each type, color, and texture required.
2. Trim: 6 inch (150 mm) long sections of each trim profile including corner section.

1.6 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For bulletin boards, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Product Test Reports: For tackboard panels, for tests performed by a qualified testing agency, for surface-burning characteristics of tackboard panels.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For bulletin boards to include in maintenance manuals.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install bulletin boards for indoor installations until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain bulletin boards from single source from single manufacturer.

2.2 ACCESSIBILITY REQUIREMENTS

A. Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

B. Protruding Objects:

1. General: Protruding objects shall comply with CBC Section 11B-307 per CBC Section 11B-307.1.

2. Protrusion Limits: Objects with leading edges more than 27 inches (686 mm) and not more than 80 inches (2032 mm) above finish floor or ground shall protrude 4 inches (102 mm) maximum horizontally into the circulation path per CBC Section 11B-307.2 and CBC Figure 11B-307.2.

C. Reach Ranges:

1. General: Reach ranges shall comply with CBC Section 11B-308 per CBC Section 11B-308.1.

D. Operable Parts:

1. General: Operable parts shall comply with CBC Section 11B-309 per CBC Section 11B-309.1.
2. Operation: Operable parts shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate operable parts shall be 5 pounds (22.2 N) maximum per CBC Section 11B-309.4.

2.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Display Cases shall withstand the effects of earthquake motions according to ASCE/SEI 7.

1. Component Importance Factor is 1.0.

B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

2.4 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Recycled Content of Particleboard: Recycled content not less than 20 percent.

C. Recycled Content of Medium-Density Fiberboard: Recycled content not less than 20 percent.

D. Particleboard:

1. Composite Wood Products: Hardwood plywood, particleboard and medium density fiberboard composite wood products used on the interior or exterior of the building shall meet the requirements for formaldehyde as specified in California Air Resources Board's (CARB) Air Toxics Control Measure (ATCM) for Composite Wood (17 CCR 93120 et seq.) per CGBC Section 5.504.4.5. Those materials not exempted under ATCM must meet the specified emission limits, as shown in CGBC Table 5.504.4.5.
2. Composite Wood Products: Products shall be made without urea formaldehyde.
3. Formaldehyde emissions shall not exceed 0.09 ppm per CGBC Table 5.504.4.5.

E. Medium-Density Fiberboard:

1. Composite Wood Products: Hardwood plywood, particleboard and medium density fiberboard composite wood products used on the interior or exterior of the building shall meet the requirements for formaldehyde as specified in California Air Resources Board's (CARB) Air Toxics Control Measure (ATCM) for Composite Wood (17 CCR 93120 et seq.) per CGBC Section 5.504.4.5. Those materials not exempted under ATCM must meet the specified emission limits, as shown in CGBC Table 5.504.4.5.
2. Composite Wood Products: Products shall be made without urea formaldehyde.
3. Formaldehyde emissions shall not exceed 0.11 ppm per CGBC Table 5.504.4.5.

F. Finish Material Pollutant Control: Finish materials shall comply with CGBC Sections 5.504.4.1 through 5.504.4.6 per CGBC Section 5.504.4.

1. Adhesives, Sealants, and Caulks: Adhesives, sealants, and caulks used on the project shall meet the requirements of the following standards per CGBC Section 5.504.4.1:

   a. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in CBC Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products specified in subparagraph below.
   b. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

2. Adhesives shall comply with maximum VOC limits listed in CGBC Table 5.504.4.1.

G. Low-Emitting Materials: Adhesives shall comply with the requirements of authorities having jurisdiction.

2.5 BULLETIN BOARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Waddell Furniture; a division of Ghent Manufacturing, Inc.; Legacy Case, Item #88-4872, or a comparable product by one of the following:

1. A-1 Visual Systems.
2. AARCO Products, Inc.
3. ADP Lemco.
4. AJW Architectural Products.
5. Architectural School Products Ltd.
6. Aywon.
7. CIG-JAN Products Ltd.
8. Claridge Products and Equipment, Inc.
9. Ghent Manufacturing, Inc.
10. Laurence, C. R. Co., Inc.
11. Marsh Industries, Inc.
12. MooreCo, Inc.
13. Nelson-Harkins Industries.
14. Peter Pepper Products, Inc.
15. Platinum Visual Systems.

16. Poblocki Sign Company.
17. Pyramid Presentation Products.
18. Signature, Inc.
19. Swingframe Mfg.; a division of Access Display Group, Inc.
20. Tablet & Ticket Co. (The).
21. Visiontron Corp.
22. Vomar Products, Inc.

B. General: Factory-fabricated unit consisting of manufacturer's standard wall-mounted cabinet with tackboard panel on back inside surface and operable glazed doors at front.

1. Frame and Cabinet Profile: Square frame section with square cabinet corners.
2. Mounting: Surface mounted.
3. Size: 72 inches (1829 mm) wide by 48 inches (1219 mm) high by 4 inches (102 mm) deep.

C. Wood-Framed Cabinet: Red oak with natural lacquered finish.

D. Glazed Sliding Doors: Tempered glass; unframed; with extruded-aluminum top and bottom track; supported on nylon or ball-bearing rollers; with plastic top guide and rubber bumpers. Equip each door with ground finger pull and adjustable cylinder lock with two keys.

1. Thickness: Not less than 6 mm thick.
2. Number of Doors: Two.

E. Back Panel: Manufacturer's standard vinyl-fabric-faced or polyester-fabric-faced tackboard panel.

F. Vinyl Back Panel: Vinyl-fabric-faced tackboard panel.

1. Color: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

G. Polyester Back Panel: Polyester-fabric-faced tackboard panel.

1. Color: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

2.6 TACKBOARD PANELS

A. Vinyl-Fabric-Faced Tackboard Panel: Vinyl fabric factory laminated to 1/2 inch (13 mm) thick, fiberboard backing.

B. Polyester-Fabric-Faced Tackboard Panel: Polyester fabric factory laminated to 1/2 inch (13 mm) thick, fiberboard backing.

2.7 MATERIALS

A. Fiberboard: ASTM C208.

B. Polyester Fabric: Nondirectional weave, 100 percent polyester; weighing not less than 15 oz./sq. yd. (508 g/sq. m); with flame-spread index of 25 or less when tested in accordance with ASTM E84.

C. Vinyl Fabric: ASTM F793/F793M, Type II, burlap weave; weighing not less than 13 oz./sq. yd. (440 g/sq. m); with flame-spread index of 25 or less when tested in accordance with ASTM E84.

D. Extruded-Aluminum Bars and Shapes: ASTM B221 (ASTM B221M), Alloy 6063.

E. Clear Tempered Glass: ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality Q3, with exposed edges seamed before tempering.

F. Fasteners: Provide screws, bolts, and other fastening devices made from same material as items being fastened, except provide hot-dip galvanized, stainless steel, or aluminum fasteners for exterior applications. Provide types, sizes, and lengths to suit installation conditions. Use security fasteners where exposed to view.

2.8 FABRICATION

A. Fabricate bulletin boards to requirements indicated for dimensions, design, and thickness and finish of materials.

B. Use metals and shapes of thickness and reinforcing required to produce flat surfaces, and to impart strength for size, design, and application indicated.

C. Fabricate cabinets and door frames with reinforced corners, mitered to a hairline fit, with no exposed fasteners.

2.9 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.10 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.

1. Color: Champagne.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

B. Examine walls and partitions for proper backing for bulletin boards.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design for accessible bulletin board mounting height. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

1. Provide continuous backing at top and bottom of boards.
2. No plastic anchors allowed.

B. Surface-Mounted Bulletin Boards: Attach bulletin boards to wall surfaces with concealed clips, hangers, or grounds fastened at not more than 16 inches (400 mm) o.c. Secure tops and bottoms of bulletin boards to walls.

C. Bulletin Board Mounting Heights: Install bulletin boards at mounting heights indicated on Drawings, or if not indicated, at heights indicated below.

1. Mounting Height: 60 inches (1524 mm) above finished floor to top of cabinet.

3.3 ADJUSTING AND CLEANING

A. Adjust doors to operate smoothly without warp or bind and so contact points meet accurately. Lubricate operating hardware as recommended in writing by manufacturer.

B. Touch up factory-applied finishes to restore damaged areas.

END OF SECTION 101200

This page intentionally left blank.

SECTION 101419 - DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cutout dimensional characters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign not less than half size.

C. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Dimensional Characters: Full-size Sample of each type and size of dimensional character.
2. Exposed Accessories: Full-size Sample of each accessory type.
3. Full-size Samples, if approved, will be returned to Contractor for use in the Project.

D. Product Schedule: For dimensional letter signs. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer of products or an entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACCESSIBLITY REQUIREMENTS

A. Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

B. Visual Characters: Visual characters shall comply with CBC Section 11B-703.5 per CBC Section 11B-703.5.

1. Exception: Where visual characters comply with CBC Section 11B-703.2 and are accompanied by Braille complying with CBC Section 11B-703.3, they shall not be required to comply with CBC Sections 11B-703.5.2 through 11B-703.5.6, 11B-703.5.8 and 11B-703.5.9.
2. Finish and Contrast: Characters and their background shall have a non-glare finish. Characters shall contrast with their background with either light characters on a dark background or dark characters on a light background per CBC Section 11B-703.5.1.
3. Case: Characters shall be uppercase or lowercase or a combination of both per CBC Section 11B-703.5.2.
4. Style: Characters shall be conventional in form. Characters shall not be italic, oblique, script, highly decorative, or of other unusual forms per CBC Section 11B-703.5.3.
5. Character Proportions: Characters shall be selected from fonts where the width of the uppercase letter "O" is 60 percent minimum and 110 percent maximum of the height of the uppercase letter "I" per CBC Section 11B-703.5.4.
6. Character Height: Minimum character height shall comply with CBC Table 11B-703.5.5. Viewing distance shall be measured as the horizontal distance between the character and an obstruction preventing further approach towards the sign. Character height shall be based on the height of the uppercase letter "I" per CBC Section 11B-703.5.5.

a. Exception: Where provided, floor plans providing emergency procedures information in accordance with Title 19 shall not be required to comply with CBC Section 11B-703.5.5.

7. Height from Finish Floor or Ground: Visual characters shall be 40 inches (1016 mm) minimum above the finish floor or ground per CBC Section 11B-703.5.6.

a. Exceptions:

1) Visual characters indicating elevator car controls shall not be required to comply with CBC Section 11B-703.5.6.
2) Floor-level exit signs complying with CBC Chapter 10, Section 1013.7 shall not be required to comply with CBC Section 11B-703.5.6.
3) Where provided, floor plans providing emergency procedures information in accordance with Title 19 shall not be required to comply with CBC Section 11B-703.5.6.

8. Stroke Thickness: Stroke thickness of the uppercase letter "I" shall be 10 percent minimum and 20 percent maximum of the height of the character per CBC Section 11B-703.5.7.
9. Character Spacing: Character spacing shall be measured between the two closest points of adjacent characters, excluding word spaces. Spacing between individual characters shall be 10 percent minimum and 35 percent maximum of the character height per CBC Section 11B-703.5.8.
10. Line Spacing: Spacing between the baselines of separate lines of characters within a message shall be 135 percent minimum and 170 percent maximum of the character height per CBC Section 11B-703.5.9.
11. Format: Text shall be in a horizontal format per CBC Section 11B-703.5.10.

2.2 PERFORMANCE REQUIREMENTS

A. Thermal Movements: For exterior dimensional letter signage, allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.3 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Regional Materials: Dimensional letter signs shall be manufactured within 500 miles (800 km) of Project site.

C. Recycled Content of Stainless Steel Products: Recycled content not less than 20 percent.

2.4 DIMENSIONAL CHARACTERS

A. Cutout Characters: Characters with uniform faces; square-cut, smooth, eased edges; precisely formed lines and profiles; and as follows:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. A.R.K. Ramos.
b. ACE Sign Systems, Inc.
c. APCO Graphics, Inc.
d. ASI Sign Systems, Inc.
e. Cosco.
f. Diskey Architectural Signage Inc.
g. Gemini Incorporated.

h. Inpro Corporation.
i. Matthews International Corporation; Bronze Division.
j. Metal Arts.
k. Metallic Arts.
l. Southwell Company (The).
m. Steel Art Company.

2. Character Material: Sheet or plate stainless steel.
3. Character Height: As indicated on Drawings.
4. Thickness: Manufacturer's standard for size of character but not less than 0.25 inch (6.35 mm).
5. Finishes:

a. Integral Stainless-Steel Finish: No. 4.

6. Mounting: Projecting studs.
7. Typeface: Arial unless otherwise indicated.

2.5 DIMENSIONAL CHARACTER MATERIALS

A. Stainless-Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.

2.6 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.

3. Sign Mounting Fasteners:

a. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.

2.7 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.

2.8 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

2.9 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
2. Directional Satin Finish: No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Mounting Methods:

1. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.
b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

3.4 DIMENSIONAL LETTER SIGNAGE SCHEDULE

A. Building Identification:

1. Type: Cutout dimensional characters.
2. Text/Message: "BUILDING NAME."
3. Character Size: As indicated on Drawings.
4. Location: Above main entrance(s) to building as indicated on Drawings.

END OF SECTION 101419

SECTION 101423 - PANEL SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Panel signs.
2. Room-identification signs.
3. Field-applied, vinyl signs.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for temporary Project identification signs and for temporary information and directional signs.
2. Section 092216 "Non-Structural Metal Framing" for metal backing for anchoring signs.
3. Section 142400 "Hydraulic Elevators" for code-required conveying equipment signage.
4. Section 210553 "Identification for Fire Suppression Piping and Equipment" for labels, tags, and nameplates for fire suppression systems and equipment.
5. Section 220553 "Identification for Plumbing Piping and Equipment" for labels, tags, and nameplates for plumbing systems and equipment.
6. Section 230553 "Identification for HVAC Piping and Equipment" for labels, tags, and nameplates for HVAC systems and equipment.
7. Section 260553 "Identification for Electrical Systems" for labels, tags, and nameplates for electrical equipment.
8. Section 265213 "Emergency and Exit Lighting" for illuminated, self-luminous, and photoluminescent exit sign units.

1.3 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

B. Accessible Route: A continuous unobstructed path that complies with the CBC and the 2010 ADA Standards for Accessible Design.

C. Braille: A system of raised bumps or dots set in established patterns to communicate letters and words to the visually impaired. System created in 1821 by Louis Braille by modifying the Barbier point writing system used for coded Army messages. Each Braille character or "cell" is made up of six dot positions, arranged in a rectangle containing two columns of three dots each.

D. Characters: Letters, numbers, punctuation marks, and typographic symbols.

E. Circulation Path: An exterior or interior way of passage from one place to another for pedestrians, including, but not limited to, walks, hallways, courtyards, stairways, and stair landings.

F. Common Use: Interior and exterior rooms, spaces, or elements that are made available for the use of students, staff, or others visiting or utilizing school facilities and the public.

G. Facility: Portions of buildings, structures, site improvements, complexes, equipment, roads, walks, passageways, parking lots, or other real or property located on a site.

H. Illuminated: Illuminated by lighting source integrally constructed as part of the sign unit.

I. Pictogram: A pictorial symbol that is recognized as representing activities, facilities, or concepts.

J. Sign: An architectural element composed of displayed text, graphic, or pictorial information. Information can be represented in a tactile format such as raised text and Braille. The overall shape of a sign can provide tactile information.

K. Space: A definable area, such as a room, toilet room, hall, assembly area, entrance, storage room, alcove, courtyard or lobby.

L. Tactile: An object that can be perceived using the sense of touch.

1.4 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For panel signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign not less than half size.

C. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Panel Signs: Full-size Sample of each type of panel sign.
2. Room-Identification Signs: Full-size Sample of each type of room-identification sign.
3. Field-Applied, Vinyl Signs: Full-size Sample of each type of vinyl sign.
4. Exposed Accessories: Full-size Sample of each accessory type.

D. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1. For signs with changeable message capability, provide information necessary to obtain replacement blank inserts or sign panels.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer of products or an entity that employs installers and supervisors who are trained and approved by manufacturer.

1.9 FIELD CONDITIONS

A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.
c. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

2.2 ACCESSIBILITY REQUIREMENTS

A. Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

B. Exit signs shall comply with applicable provisions in CBC Section 1013.

1. Raised Character and Braille Exit Signs: Tactile exit signs shall be required at the following locations per CBC Section 1013.4:

a. Each grade-level exterior exit door that is required to comply with CBC Section 1013.1, shall be identified by a tactile exit sign with the word, "EXIT".
b. Each exit door that is required to comply with Section 1013.1, and that leads to a grade-level exterior exit by means of a stairway or ramp shall be identified by a tactile exit sign with the following words as appropriate:

1) "EXIT STAIR DOWN".
2) "EXIT RAMP DOWN".
3) "EXIT STAIR UP".
4) "EXIT RAMP UP".

c. Each exit door that is required to comply with CBC Section 1013.1, and that leads directly to a grade-level exterior exit by means of an exit enclosure or an exit passageway shall be identified by a tactile exit sign with the words, "EXIT ROUTE".
d. Each exit access door from an interior room or area to a corridor or hallway that is required to comply with CBC Section 1013.1, shall be identified by a tactile exit sign with the words, "EXIT ROUTE".
e. Each exit door through a horizontal exit that is required to comply with CBC Section 1013.1, shall be identified by a sign with the words, "TO EXIT".
f. Raised character and Braille exit signs shall comply with CBC Chapter 11A, Section 1143A or CBC Chapter 11B, Sections 11B-703.1, 11B-703.2, 11B-703.3, and 11B-703.5.

C. Stairway Identification Signs: A sign shall be provided at each floor landing in an interior exit stairway and ramp connecting more than three stories designating the floor level, the terminus of the top and bottom of the interior exit stairway and ramp and the identification of the stairway or ramp. The signage shall also state the story of, and the direction to, the exit discharge and the availability of roof access from the interior exit stairway and ramp for the fire department. The sign shall be located 5 feet (1524 mm) above the floor landing in a position that is readily visible when the doors are in the open and closed positions per CBC Section 1023.9.

1. In addition to the stairway identification signs, raised characters and braille floor identification signs that comply with Chapter 11A, Section 1143A or Chapter 11B shall be located at the landing of each floor level, placed adjacent to the door on the latch side, in all enclosed stairways in buildings two or more stories in height to identify the floor level. At the exit discharge level, the sign shall include a raised five pointed star located to the left of the identifying floor level. The outside diameter of the star shall be the same height as the height of the raised characters.
2. Signage Requirements: Stairway identification signs shall comply with all of the following requirements:

a. The sign shall be a minimum size of 18 inches (457 mm) by 12 inches (305 mm).
b. The letters designating the identification of the interior exit stairway and ramp, such as STAIR NO. 1 or WEST STAIR, shall be placed at the top of the sign and shall be not less than 1-1/2 inches (38 mm) in height block lettering with 1/4 inch (6 mm) strokes.
c. The number designating the floor level shall be not less than 5 inches (127 mm) in height with 3/4 inch (19 mm) strokes and located in the center of the sign. The mezzanine levels shall have

the letter "M" preceding the floor level. Basement levels shall have the letter "B" preceding the floor number.

d. Other lettering and numbers shall be not less than 1 inch (25 mm) in height.
e. The stairway's upper terminus, such as ROOF ACCESS or NO ROOF ACCESS, shall be placed under the stairway identification in 1 inch (25 mm) high block lettering with 1/4 inch (6 mm) strokes.
f. The lower and upper terminus of the stairway shall be placed at the bottom of the sign in 1 inch (25 mm) high block lettering with 1/4 inch (6 mm) strokes.
g. Characters and their background shall have a non-glare finish. Characters shall contrast with their background, with either light characters on a dark background or dark characters on a light background.
h. Where signs are required by CBC Section 1023.9 are installed in the interior exit stairways and ramps of buildings subject to CBC Section 1025, the signs shall be made of the same material as required by CBC Section 1025.4.

D. Elevator Lobby Identification Signs: At landings in interior exit stairways where two or more doors lead to the floor level, any door with direct access to an enclosed elevator lobby shall be identified by signage located on the door or directly adjacent to the door stating "ELEVATOR LOBBY." Signage shall be in accordance with CBC Section 1023.9.1, Items 4, 5, and 6 per CBC Section 1023.10.

E. Geometric Symbols: Geometric symbols complying with CBC Section 11B-703.7.2.6 shall be provided at entrances to toilet and bathing rooms per CBC Section 11B-216.8.1.

1. Exceptions:

a. Geometric symbols shall not be required at entrances to toilet and bathing rooms located within private or semi-private rooms or spaces. Such spaces include but are not limited to: patient sleeping rooms, transient lodging guest rooms, and residential dwelling units.
b. Geometric symbols shall not be required at entrances to inmate toilet rooms and bathing rooms in detention and correctional facilities where only one gender is housed.

F. Floor Identification: Floor identification signs required by CBC Chapter 10, Section 1023.9 complying with CBC Sections 11B-703.1, 11B-703.2, 11B-703.3, and 11B-703.5 shall be located at the landing of each floor level, placed adjacent to the door on the latch side, in all enclosed stairways in buildings two or more stories in height to identify the floor level. At the exit discharge level, the sign shall include a raised five pointed star located to the left of the identifying floor level. The outside diameter of the star shall be the same as the height of the raised characters per CBC Section 11B-504.8.

G. Signs:

1. General: Signs shall comply with CBC Section 11B-703. Where both visual and tactile characters are required, either one sign with both visual and tactile characters, or two separate signs, one with visual, and one with tactile characters, shall be provided per CBC Section 11B-703.1.
2. Raised Characters: Raised characters shall comply with CBC Section 11B-703.2 and shall be duplicated in Braille complying with CBC Section 11B-703.3. Raised characters shall be installed in accordance with CBC Section 11B-703.4 per CBC Section 11B-703.2.

a. Depth: Raised characters shall be 1/32 inch (0.8 mm) minimum above their background per CBC Section 11B-703.2.1.
b. Case: Characters shall be uppercase per CBC Section 11B-703.2.2.
c. Style: Characters shall be sans serif. Characters shall not be italic, oblique, script, highly decorative, or of other unusual forms per CBC Section 11B-703.2.3.

d. Character Proportions: Characters shall be selected from fonts where the width of the uppercase letter "O" is 60 percent minimum and 110 percent maximum of the height of the uppercase letter "I" per CBC Section 11B-703.2.4.
e. Character Height: Character height measured vertically from the baseline of the character shall be 5/8 inch (15.9 mm) minimum and 2 inches (51 mm) maximum based on the height of the uppercase letter "I" per CBC Section 11B-703.2.5 and CBC Figure 11B-703.2.5.
f. Stroke Thickness: Stroke thickness of the uppercase letter "I" shall be 15 percent maximum of the height of the character per CBC Section 11B-703.2.6.
g. Character Spacing: Character spacing shall be measured between the two closest points of adjacent raised characters within a message, excluding word spaces. Where characters have rectangular cross sections, spacing between individual raised characters shall be 1/8 inch (3.2 mm) minimum and 4 times the raised character stroke width maximum. Where characters have other cross sections, spacing between individual raised characters shall be 1/16 inch (1.6 mm) minimum and 4 times the raised character stroke width maximum at the base of the cross sections, and 1/8 inch (3.2 mm) minimum and 4 times the raised character stroke width maximum at the top of the cross sections. Characters shall be separated from raised borders and decorative elements 3/8 inch (9.5 mm) minimum per CBC Section 11B-703.2.7.
h. Line Spacing: Spacing between the baselines of separate lines of raised characters within a message shall be 135 percent minimum and 170 percent maximum of the raised character height per CBC Section 11B-703.2.8.
i. Format: Text shall be in a horizontal format per CBC Section 11B-703.2.9.

3. Braille: Braille shall be contracted (Grade 2) and shall comply with CBC Sections 11B-703.3 and 11B-703.4 per CBC Section 11B-703.3.

a. Dimensions and Capitalization: Braille dots shall have a domed or rounded shape and shall comply with CBC Table 11B-703.3.1 and CBC Figure 11B-703.3.1. The indication of an uppercase letter or letters shall only be used before the first word of sentences, proper nouns, and names, individual letters of the alphabet, initials, and acronyms per CBC Section 11B-703.3.1.

1) Dot Base Diameter: 0.059 inches (1.5 mm) minimum to 0.063 inches (1.6 mm) maximum per CBC Table 11B-703.3.1 and CBC Figure 11B-703.3.1.
2) Distance Between Two Dots in the Same Cell: 0.100 inches (2.5 mm) measured center to center per CBC Table 11B-703.3.1 and CBC Figure 11B-703.3.1.
3) Distance Between Corresponding Dots in Adjacent Cells: 0.300 inches (7.6 mm) measured center to center per CBC Table 11B-703.3.1 and CBC Figure 11B-703.3.1.
4) Dot Height: 0.025 inches (0.6 mm) minimum to 0.037 inches (0.9 mm) maximum per CBC Table 11B-703.3.1 and CBC Figure 11B-703.3.1.
5) Distance Between Corresponding Dots From One Cell Directly Below: 0.395 inches (10 mm) minimum to 0.400 inches (10.2 mm) maximum measured center to center per CBC Table 11B-703.3.1 and CBC Figure 11B-703.3.1.

b. Position: Braille shall be positioned below the corresponding text in a horizontal format, flush left or centered. If text is multi-lined, Braille shall be placed below the entire text. Braille shall be separated 3/8 inch (9.5 mm) minimum and 1/2 inch (12.7 mm) maximum from any other tactile characters and 3/8 inch (9.5 mm) minimum from raised borders and decorative elements per CBC Section 11B-703.3.2 and CBC Figure 11B-703.3.2.

1) Exception: Braille provided on elevator car controls shall be separated by 3/16 inch (4.8 mm) minimum and shall be located directly below the corresponding raised characters or symbols.

4. Installation Height and Location: Signs with tactile characters shall comply with CBC Section 11B-703.4 per CBC Section 11B-703.4.

    a. Height Above Finish Floor or Ground: Tactile characters on signs shall be located 48 inches (1219 mm) minimum above the finish floor or ground surface, measured from the baseline of the lowest Braille cells and 60 inches (1524 mm) maximum above the finish floor or ground surface, measured from the baseline of the highest line of raised characters per CBC Section 11B-703.4.1 and CBC Figure 11B-703.4.1.

        1) Exception: Tactile characters for elevator car controls shall not be required to comply with CBC Section 11B-703.4.1.

    b. Location: Where a tactile sign is provided at a door, the sign shall be located alongside the door at the latch side. Where a tactile sign is provided at double doors with one active leaf, the sign shall be located on the inactive leaf. Where a tactile sign is provided at double doors with two active leafs, the sign shall be located to the right of the right hand door. Where there is no wall space at the latch side of a single door or at the right side of double doors, signs shall be located on the nearest adjacent wall. Signs containing tactile characters shall be located so that a clear floor space of 18 inches (457 mm) minimum by 18 inches (457 mm) minimum, centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45 degree open position. Where provided, signs identifying permanent rooms and spaces shall be located at the entrance to, and outside of the room or space. Where provided, signs identifying exits shall be located at the exit door when approached in the direction of egress travel per CBC Section 11B-703.4.2 and CBC Figure 11B-703.4.2.

        1) Exception: In alterations where sign installation locations identified in CBC Section 11B-703.4.2 are obstructed or otherwise unavailable for sign installation, signs with tactile characters shall be permitted on the push side of doors with closers and without hold-open devices.

5. Visual Characters: Visual characters shall comply with CBC Section 11B-703.5 per CBC Section 11B-703.5.

    a. Exception: Where visual characters comply with CBC Section 11B-703.2 and are accompanied by Braille complying with CBC Section 11B-703.3, they shall not be required to comply with CBC Sections 11B-703.5.2 through 11B-703.5.6, 11B-703.5.8 and 11B-703.5.9.
    b. Finish and Contrast: Characters and their background shall have a non-glare finish. Characters shall contrast with their background with either light characters on a dark background or dark characters on a light background per CBC Section 11B-703.5.1.
    c. Case: Characters shall be uppercase or lowercase or a combination of both per CBC Section 11B-703.5.2.
    d. Style: Characters shall be conventional in form. Characters shall not be italic, oblique, script, highly decorative, or of other unusual forms per CBC Section 11B-703.5.3.
    e. Character Proportions: Characters shall be selected from fonts where the width of the uppercase letter "O" is 60 percent minimum and 110 percent maximum of the height of the uppercase letter "I" per CBC Section 11B-703.5.4.
    f. Character Height: Minimum character height shall comply with CBC Table 11B-703.5.5. Viewing distance shall be measured as the horizontal distance between the character and an obstruction preventing further approach towards the sign. Character height shall be based on the height of the uppercase letter "I" per CBC Section 11B-703.5.5.

1) Exception: Where provided, floor plans providing emergency procedures information in accordance with Title 19 shall not be required to comply with CBC Section 11B-703.5.5.

g. Height from Finish Floor or Ground: Visual characters shall be 40 inches (1016 mm) minimum above the finish floor or ground per CBC Section 11B-703.5.6.

1) Exceptions:

a) Visual characters indicating elevator car controls shall not be required to comply with CBC Section 11B-703.5.6.
b) Floor-level exit signs complying with CBC Chapter 10, Section 1013.7 shall not be required to comply with CBC Section 11B-703.5.6.
c) Where provided, floor plans providing emergency procedures information in accordance with Title 19 shall not be required to comply with CBC Section 11B-703.5.6.

h. Stroke Thickness: Stroke thickness of the uppercase letter "I" shall be 10 percent minimum and 20 percent maximum of the height of the character per CBC Section 11B-703.5.7.
i. Character Spacing: Character spacing shall be measured between the two closest points of adjacent characters, excluding word spaces. Spacing between individual characters shall be 10 percent minimum and 35 percent maximum of the character height per CBC Section 11B-703.5.8.
j. Line Spacing: Spacing between the baselines of separate lines of characters within a message shall be 135 percent minimum and 170 percent maximum of the character height per CBC Section 11B-703.5.9.
k. Format: Text shall be in a horizontal format per CBC Section 11B-703.5.10.

6. Pictograms: Pictograms shall comply with CBC Section 11B-703.6 per CBC Section 11B-703.6.

a. Pictogram Field: Pictograms shall have a field height of 6 inches (152 mm) minimum. Characters and Braille shall not be located in the pictogram field per CBC Section 11B-703.6.1 and CBC Figure 11B-703.6.1.
b. Finish and Contrast: Pictograms and their field shall have a non-glare finish. Pictograms shall contrast with their field with either a light pictogram on a dark field or a dark pictogram on a light field per CBC Section 11B-703.6.2.
c. Text Descriptors: Pictograms shall have text descriptors located directly below the pictogram field. Text descriptors shall comply with CBC Sections 11B-703.2, 11B-703.3, and 11B-703.4 per CBC Section 11B-703.6.3.

7. Symbols of Accessibility: Symbols of accessibility shall comply with CBC Section 11B-703.7 per CBC Section 11B-703.7.

a. Finish and Contrast: Symbols of accessibility and their background shall have a non-glare finish. Symbols of accessibility shall contrast with their background with either a light symbol on a dark background or a dark symbol on a light background per CBC Section 11B-703.7.1.
b. Symbols:

1) International Symbol of Accessibility: The International Symbol of Accessibility shall comply with CBC Figure 11B-703.7.2.1. The symbol shall consist of a white figure on a blue background. The color blue shall approximate FS 15090 in Federal Standard 595C per CBC Section 11B-703.7.2.1.

a) Exceptions:

(1) The appropriate enforcement agency may approve other colors provided the symbol contrast is light on dark or dark on light.
(2) On the accessibility function button on hall call consoles in a destination-oriented elevator system the International Symbol of Accessibility shall be a white symbol on a black background.

2) International Symbol of TTY: The International Symbol of TTY shall comply with CBC Figure 11B-703.7.2.2 per CBC Section 11B-703.7.2.2.
3) Volume Control Telephones: Telephones with a volume control shall be identified by a pictogram of a telephone handset with radiating sound waves on a square field such as shown in CBC Figure 11B-703.7.2.3 per CBC Section 11B-703.7.3.2.
4) Assistive Listening Systems: Assistive listening systems shall be identified by the International Symbol of Access for Hearing Loss complying with CBC Figure 11B-703.7.2.4 per CBC Section 11B-703.7.2.4.
5) Reserved.
6) Toilet and Bathing Facilities Geometric Symbols: Geometric symbols at entrances to toilet and bathing rooms shall be mounted at 58 inches (1473 mm) minimum and 60 inches (1524 mm) maximum above the finish floor or ground surface measured from the centerline of the symbol. Where a door is provided the symbol shall be mounted within 1 inch (25 mm) of the vertical centerline of the door per CBC Section 11B-703.7.2.6.

a) Men's Toilet and Bathing Facilities: An equilateral triangle, 1/4 inch (6.4 mm) thick with edges 12 inches (305 mm) long and a vertex pointing upward, shall be located at entrances to men's toilet and bathing facilities. The triangle symbol shall contrast with the door, either light on a dark background or dark on a light background per CBC Section 11B-703.7.2.6.1.

(1) Exception: Within secure perimeter of detention and correctional facilities, geometric symbols shall not be required to be 1/4 inch (6.4 mm) thick.

b) Women's Toilet and Bathing Facilities: A circle, 1/4 inch (6.4 mm) thick and 12 inches (305 mm) in diameter, shall be located at entrances to women's toilet and bathing facilities. The circle symbol shall contrast with the door, either light on a dark background or dark on a light background per CBC Section 11B-703.7.2.6.2.

(1) Exception: Within secure perimeter of detention and correctional facilities, geometric symbols shall not be required to be 1/4 inch (6.4 mm) thick.

c) Unisex Toilet and Bathing Facilities: A circle, 1/4 inch (6.4 mm) thick and 12 inches (305 mm) in diameter with a 1/4 inch (6.4 mm) thick triangle with a vertex pointing upward, superimposed on and geometrically inscribed within the circle and within the 12 inch (305 mm) diameter, shall be provided at entrances to unisex toilet and bathing facilities. The vertices of the triangle shall be located 1/4 inch (6.4 mm) maximum from the edge of the circle. The triangle symbol shall contrast with the circle symbol, either light on a dark background or dark on a light background. The circle symbol shall contrast with the door, either light on a dark background or dark on a light background per CBC Section 11B-703.7.2.6.3.

(1) Exception: Within secure perimeter of detention and correctional facilities, geometric symbols shall not be required to be 1/4 inch (6.4 mm) thick.

d) Edges and Vertices on Geometric Symbols: Edges shall be eased or rounded at 1/16 inch (1.59 mm) minimum, or chamfered at 1/8 inch (3.2 mm) maximum. Vertices shall be radiused between 1/8 inch (3.2 mm) minimum and 1/4 inch (6.4 mm) maximum per CBC Section 11B-703.7.2.6.4 and CBC Figure 11B-703.7.2.6.4.

2.3 PERFORMANCE REQUIREMENTS

A. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.4 SUSTAINABLITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Regional Materials: Products shall be manufactured within 500 miles (800 km) of Project site.

C. Finish Material Pollutant Control: Finish materials shall comply with CGBC Sections 5.504.4.1 through 5.504.4.6 per CGBC Section 5.504.4.

1. Adhesives, Sealants, and Caulks: Adhesives, sealants, and caulks used on the project shall meet the requirements of the following standards per CGBC Section 5.504.4.1:

   a. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in CBC Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products specified in subparagraph below.
   b. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

2. Adhesives shall comply with maximum VOC limits listed in CGBC Table 5.504.4.1.
3. Sealants and sealant primers shall comply with maximum VOC limits listed in CGBC Table 5.504.4.2.
4. Paints and Coatings: Architectural paints and coatings shall comply with VOC limits in Table 1 of the ARB Architectural Coatings Suggested Control Measure, as shown in CGBC Table 5.504.4.3, unless more stringent local limits apply. The VOC content limit for coatings that do not meet the definitions for the specialty coatings categories listed in CGBC Table 5.504.4.3 shall be determined by classifying the coating as a Flat, Nonflat, or Nonflat-High Gloss coating, based on its gloss, as defined in Subsections 4.21, 4.36, and 4.37 of the 2007 California Air Resources Board Suggested Control Measure, and the corresponding Flat, Nonflat, or Nonflat-High Gloss VOC limit in CGBC Table 5.504.4.3 shall apply per CGBC Section 5.504.4.3.

D. VOC Content: Adhesives shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Multipurpose Construction Adhesives: 70 g/L.

E. VOC Content: Sealants and sealant primers shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Architectural Sealants: 250 g/L.
2. Architectural Sealant Primers for Nonporous Substrates: 250 g/L.
3. Architectural Sealant Primers for Porous Substrates: 775 g/L.

F. Low-Emitting Materials: Adhesives shall comply with the requirements of authorities having jurisdiction.

G. Low-Emitting Materials: Sealants and sealant primers shall comply with the requirements of authorities having jurisdiction.

H. Low-Emitting Materials: Paints and coatings shall comply with the requirements of authorities having jurisdiction.

2.5 SIGNS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. ACE Sign Systems, Inc.
2. Advance Corporation.
3. Allen Industries Architectural Signage.
4. Allen Markings.
5. APCO Graphics, Inc.
6. ASE, Inc.
7. ASI Sign Systems, Inc.
8. Best Sign Systems, Inc.
9. Bunting Graphics, Inc.
10. Clarke Systems.
11. Cosco.
12. Diskey Architectural Signage Inc.
13. Fossil Industries, Inc.
14. Inpro Corporation.
15. Mohawk Sign Systems.
16. Nelson-Harkins Industries.
17. Poblocki Sign Company, LLC.
18. Seton Identification Products.
19. Signs & Decal Corp.
20. Stamprite Supersine; a division of Stamp Rite Inc.
21. Vista System.
22. Vomar Products, Inc.

B. Panel Signs: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Laminated-Sheet Sign: Acrylic face sheet with flush acrylic graphics laminated to face sheet to produce composite sheet.

a. Face Sheet Thickness: 0.25 inch (6.35 mm).

2. Sign-Panel Perimeter: Finish edges smooth.

a. Edge Condition: Bullnosed, manufacturer's standard radius.
b. Corner Condition in Elevation: Rounded to radius indicated on Drawings or, if not indicated, 0.5 inch (12.70 mm).

1) Provide corners that are rounded to radius indicated on Drawings or, if not indicated, not less than 1/8 inch (3.2 mm) and not more than 1/4 inch (6.4 mm) on door mounted signs.

3. Mounting: Surface mounted to wall and door with countersunk flathead through fasteners unless otherwise indicated.

a. Surface mount to glass with adhesive where indicated.

4. Surface Finish and Applied Graphics:

a. Integral Acrylic Sheet Color:

1) Face Sheet Color: Blue shall approximate FS 15090 in Federal Standard 595C unless otherwise indicated.
2) Raised and Flush Graphics Color: White unless otherwise indicated.
3) The appropriate enforcement agency may approve other colors provided the symbol contrast is light on dark or dark on light.

5. Pictorial Symbol Signs (Pictograms): The outside dimension of the pictogram field shall be not less than 6 inches (152.4 mm) in height.
6. Text and Typeface:

a. Arial unless otherwise indicated.
b. Finish characters to contrast with background color.

7. Flatness Tolerance: Sign panel shall remain flat or uniformly curved under installed conditions as indicated and within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner.

C. Room-Identification Signs: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Laminated-Sheet Sign: Acrylic face sheet with raised acrylic graphics laminated to face sheet to produce composite sheet.

a. Face Sheet Thickness: 0.25 inch (6.35 mm).

2. Sign-Panel Perimeter: Finish edges smooth.

a. Edge Condition: Bullnosed, manufacturer's standard radius.
b. Corner Condition in Elevation: Rounded to radius indicated on Drawings or, if not indicated, 0.5 inch (12.70 mm).

3. Mounting: Surface mounted to wall with countersunk flathead through fasteners unless otherwise indicated.

    a. Surface mount to glass with adhesive where indicated.

4. Surface Finish and Applied Graphics:

    a. Integral Acrylic Sheet Color:

        1) Face Sheet Color: Blue shall approximate FS 15090 in Federal Standard 595C unless otherwise indicated.
        2) Raised and Flush Graphics Color: White unless otherwise indicated.
        3) The appropriate enforcement agency may approve other colors provided the symbol contrast is light on dark or dark on light.

5. Pictorial Symbol Signs (Pictograms): Pictorial symbol signs (pictograms) shall be raised not less than 1/32 inch (0.794 mm) and shall be accompanied by the verbal description placed directly below the pictogram. The outside dimension of the pictogram field shall be not less than 6 inches (152.4 mm) in height.
6. Text and Typeface:

    a. Arial unless otherwise indicated.
    b. Accessible raised characters unless otherwise indicated.

        1) Raised characters shall be raised not less than 1/32 inch (0.794 mm) and shall be sans serif uppercase characters accompanied by contracted (Grade 2) Braille placed directly below the raised characters.
        2) Raised characters shall be not less than 5/8 inch (15.875 mm) and not more than 2 inches (50.8 mm) high.

    c. Braille:

        1) Contracted (Grade 2) Braille shall be used whenever Braille is required.
        2) Dot Base Diameter: Not less than 0.059 inch (1.5 mm) and not more than 0.063 inch (1.6 mm).
        3) Distance Between Two Dots in the Same Cell: 0.100 inch (2.5 mm) measured center to center.
        4) Distance Between Corresponding Dots in Adjacent Cells: 0.300 inch (7.6 mm) measured center to center.
        5) Dot Height: Not less than 0.025 inch (0.6 mm) and not more than 0.037 inch (0.9 mm).
        6) Distance Between Corresponding Dots From One Cell Directly Below: Not less than 0.395 inch (10 mm) and not more than 0.400 inch (10.2 mm) measured center to center.
        7) Each dot shall be distinct and separate and shall have a rounded or domed top.

    d. Finish raised characters to contrast with background color, and finish Braille to match background color.

7. Flatness Tolerance: Sign panel shall remain flat or uniformly curved under installed conditions as indicated and within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner.

2.6 FIELD-APPLIED, VINYL SIGNS

A. Field-Applied, Vinyl Signs: Die cut from not less than 3.5 mil (0.089 mm) thick, weather-resistant vinyl film with release liner on the back.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Allen Markings.
    b. APCO Graphics, Inc.
    c. Mohawk Sign Systems.
    d. Seton Identification Products.

2. Size: As indicated.
3. Substrate: Glass.

2.7 PANEL-SIGN MATERIALS

A. Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

B. Vinyl Film: UV-resistant vinyl film of nominal thickness indicated, with pressure-sensitive, permanent adhesive on back; die cut to form characters or images as indicated and suitable for exterior applications.

2.8 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
3. Exposed Metal-Fastener Components, General:

    a. Fabricated from stainless-steel unless otherwise indicated.
    b. Fastener Heads: For nonstructural connections, use countersunk flathead screws with tamper-resistant Allen-head, spanner-head, or one-way-head slots unless otherwise indicated.

4. Sign Mounting Fasteners:

    a. Through Fasteners: Exposed metal fasteners, with type of head indicated, installed in predrilled holes.

5. Inserts: Furnish inserts to be set by other trades into concrete or masonry work.

B. Adhesives:

1. As recommended by sign manufacturer.

2.9 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

B. Surface-Engraved Graphics: Machine engrave characters and other graphic devices into panel surface indicated to produce precisely formed copy, incised to uniform depth.

1. Engraved Opaque Acrylic Sheet: Fill engraved graphics with manufacturer's standard enamel.

C. Signs with Changeable Message Capability: Fabricate signs to allow insertion of changeable messages as follows:

1. For slide-in changeable inserts, fabricate slot without burrs or constrictions that inhibit function. Furnish initial changeable insert. Furnish two blank inserts for each sign for Owner's use.

2.10 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Verify that anchor inserts are correctly sized and located to accommodate signs.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SIGN LOCATIONS

A. Sign locations shown on plan drawings are for code compliance only. Contractor shall arrange a meeting with the Architect, Owner’s Representative, Inspector, Fire Marshall and all other concerned parties at the site to review and approve precise final locations.

3.3 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Room-Identification Signs and Other Accessible Signage: Install in locations on walls and doors as indicated and according to accessibility standard.

C. Mounting Methods:

1. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
2. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.

D. Field-Applied, Vinyl Signs: Clean and dry substrate. Align sign in final position before removing release liner. Remove release liner in stages, and apply and firmly press sign into final position. Press from the middle outward to obtain good bond without blisters or fishmouths.

E. Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.

3.4 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

3.5 SIGN SCHEDULE

A. Panel Signs:

1. Door Mounted Toilet Room Door Identification – Men: Comply with CBC Sections 11B-216.8, 11B-703.7.2.6, 11B-703.7.2.6.1, and the following:

a. Sign Size: 1/4 inch (6.350 mm) thick and with edges 12 inches (305 mm) long.
b. Sign Shape: Equilateral triangle with vertex pointing upward.
c. Border Size: None.
d. Pictogram: None or International Symbol of Accessibility flush with sign face.
e. Copy: None.

f. Character Size: None.
g. Text/Message: None.
h. Location: Door.
i. Color: The triangle symbol shall contrast with the door, either light on a dark background or dark on a light background per CBC Section 11B-703.7.2.6.1.

2. Door Mounted Toilet Room Door Identification – Women: Comply with CBC Sections 11B-216.8, 11B-703.7.2.6, 11B-703.7.2.6.2, and the following:

a. Sign Size: 1/4 inch (6.350 mm) thick and 12 inches (305 mm) in diameter.
b. Sign Shape: Circle.
c. Border Size: None.
d. Pictogram: None or International Symbol of Accessibility flush with sign face.
e. Copy: None.
f. Character Size: None.
g. Text/Message: None.
h. Location: Door.
i. Color: The circle symbol shall contrast with the door, either light on a dark background or dark on a light background per CBC Section 11B-703.7.2.6.2.

3. Room Occupancy Sign:

a. Sign Size: As indicated or as required to fit required text.
b. Pictogram: None.
c. Copy: As indicated.
d. Character Size: As indicated. Not less than 5/8 inch (15.9 mm) high and not more than 2 inches (51 mm) high.

1) Characters are not required to be tactile and copy can be flush with surface or engraved.

e. Text/Message: As indicated.
f. Location: Wall, where indicated.

4. Assistive Listening System: Comply with CBC Section 11B-216.10 and the following:

a. Sign Size: As indicated or as required to fit required text.
b. Pictogram: International Symbol of Access for Hearing Loss.
c. Copy: As indicated.
d. Character Size: As indicated. Not less than 5/8 inch (15.9 mm) high and not more than 2 inches (51 mm) high.

1) Characters are not required to be tactile and copy can be flush with surface or engraved.

e. Text/Message: As indicated.
f. Location: Wall, where indicated.
g. International Symbol of Access for Hearing Loss: The International Symbol of Access for Hearing Loss complying with CBC Figure 11B-703.7.2.4 per CBC Section 11B-703.7.2.4.

5. Accessible Entrance Identification: Comply with CBC Section 11B-216.6 and the following:

a. Sign Size: 8 by 8 inches (203 by 203 mm).
b. Pictogram: International Symbol of Accessibility.

1) Pictogram may be flush with surface or raised.

c. Copy: None.
d. Character Size: None.
e. Text/Message: None.
f. Location: All building entrances that are accessible to and useable by persons with disabilities and where indicated.
g. International Symbol of Accessibility: The International Symbol of Accessibility shall comply with CBC Figure 11B-703.7.2.1. The symbol shall consist of a white figure on a blue background. The color blue shall approximate FS 15090 in Federal Standard 595C per CBC Section 11B-703.7.2.1.

1) The appropriate enforcement agency may approve other colors provided the symbol contrast is light on dark or dark on light.

6. Accessible Path of Travel Directional Sign: Comply with CBC Section 11B-216.6 and the following:

a. Sign Size: 8 by 8 inches (203 by 203 mm).
b. Pictograms: International Symbol of Accessibility and directional arrow.

1) Pictograms may be flush with surface or raised.

c. Copy: None.
d. Character Size: None.
e. Text/Message: None.
f. Location: At junctions along pedestrian ways approaching building entrances that are accessible to and useable by persons with disabilities and where indicated.
g. International Symbol of Accessibility: The International Symbol of Accessibility shall comply with CBC Figure 11B-703.7.2.1. The symbol shall consist of a white figure on a blue background. The color blue shall approximate FS 15090 in Federal Standard 595C per CBC Section 11B-703.7.2.1.

1) The appropriate enforcement agency may approve other colors provided the symbol contrast is light on dark or dark on light.

7. Nonsmoking Building Identification: Comply with CBC Sections 11B-703.4.1 and 11B-703.4.2, CGBC Section 5.504.7 and the following:

a. Sign Size: As indicated or as required to fit required text.
b. Pictogram: Red circle with diagonal line superimposed over cigarette.
c. Copy: Tactile and Braille.
d. Character Size: As indicated. Not less than 5/8 inch (15.9 mm) high and not more than 2 inches (51 mm) high.
e. Text/Message: "SMOKING IS NOT PERMITTED WITHIN THE BUILDING OR WITHIN 25 FEET (8 M) OF ENTRANCES, OPERABLE WINDOWS, OR OUTDOOR-AIR INTAKES".
f. Location: Wall, at each exterior door and where indicated.

B. Room and Door Identification Signs:

1. Door Identification: Comply with CBC Sections 11B-216.2, 11B-703.4.1 and 11B-703.4.2 and the following:

a. Sign Size: 8 by 8 inches (203 by 203 mm).
b. Pictogram: None.
c. Copy: Tactile and Braille.
d. Character Size: As indicated. Not less than 5/8 inch (15.9 mm) high and not more than 2 inches (51 mm) high.
e. Text/Message: As indicated.
f. Location: Wall, where indicated.

2. Changeable Door Identification: Comply with CBC Sections 11B-216.2, 11B-703.4.1 and 11B-703.4.2 and the following:

a. Sign Size: 8 by 8 inches (203 by 203 mm).
b. Paper Insert Size: 8 by 5 inches (203 by 127 mm).
c. Pictogram: None.
d. Copy: Tactile and Braille.
e. Character Size: As indicated. Not less than 5/8 inch (15.9 mm) high and not more than 2 inches (51 mm) high.
f. Text/Message: As indicated.
g. Location: Wall, where indicated.

3. Wall Mounted Toilet Room Door Identification – Men: Comply with CBC Sections 11B-216.2, 11B-703.4.1 and 11B-703.4.2 and the following:

a. Sign Size: 8 by 8 inches (203 by 203 mm).
b. Pictogram: International Symbol of Accessibility.

1) Note: The International Symbol of Accessibility may be located on a separate sign adjacent to the wall mounted toilet room door identification sign.
2) Note: The "man" pictogram is not required by code. Provide "man" pictogram if indicated on Drawings.

c. Copy: Tactile and Braille.
d. Character Size: As indicated. Not less than 5/8 inch (15.9 mm) high and not more than 2 inches (51 mm) high.
e. Text/Message: "MEN" or as indicated.
f. Location: As indicated.
g. International Symbol of Accessibility: The International Symbol of Accessibility shall comply with CBC Figure 11B-703.7.2.1. The symbol shall consist of a white figure on a blue background. The color blue shall approximate FS 15090 in Federal Standard 595C per CBC Section 11B-703.7.2.1.

1) The appropriate enforcement agency may approve other colors provided the symbol contrast is light on dark or dark on light.

4. Wall Mounted Toilet Room Door Identification – Women: Comply with CBC Sections 1117B.5.1.1, 1117B.5.7 and the following:

a. Sign Size: 8 by 8 inches (203 by 203 mm).
b. Pictogram: International Symbol of Accessibility.

1) Note: The International Symbol of Accessibility may be located on a separate sign adjacent to the wall mounted toilet room door identification sign.

2) Note: The "woman" pictogram is not required by code. Provide "woman" pictogram if indicated on Drawings.

c. Copy: Tactile and Braille.
d. Character Size: As indicated. Not less than 5/8 inch (15.9 mm) high and not more than 2 inches (51 mm) high.
e. Text/Message: "WOMEN" or as indicated.
f. Location: Wall, where indicated.
g. International Symbol of Accessibility: The International Symbol of Accessibility shall comply with CBC Figure 11B-703.7.2.1. The symbol shall consist of a white figure on a blue background. The color blue shall approximate FS 15090 in Federal Standard 595C per CBC Section 11B-703.7.2.1.

1) The appropriate enforcement agency may approve other colors provided the symbol contrast is light on dark or dark on light.

5. Tactile Exit Door Identification: Comply with CBC Sections 1013.4, 11B-703.4.1 and 11B-703.4.2 and the following:

a. Sign Size: 8 by 8 inches (203 by 203 mm).
b. Pictogram: None.
c. Copy: Tactile and Braille.
d. Character Size: As indicated. Not less than 5/8 inch (15.9 mm) high and not more than 2 inches (51 mm) high maximum.
e. Text/Message: "EXIT".
f. Location: Wall, at each grade-level exterior exit door and where indicated.

6. Tactile Stair Level Identification Sign: Comply with CBC Sections 1023.9, 11B-703.4.1 and 11B-703.4.2 and the following:

a. Sign Size: 8 by 8 inches (203 by 203 mm).
b. Pictogram: At exit discharge level, the sign shall include a raised five pointed star located to the left of the raised characters identifying floor level. The outside diameter of the star shall be the same as the height of the raised characters identifying floor level.
c. Copy: Tactile and Braille.
d. Character Size: As indicated. Not less than 5/8 inch (15.9 mm) high and not more than 2 inches (51 mm) high.
e. Text/Message: Floor level.
f. Location: Wall, at each door in enclosed stairway and where indicated.

7. Tactile Exit Stair Door Identification: Comply with CBC Sections 1013.4, 11B-703.4.1 and 11B-703.4.2 and the following:

a. Sign Size: 8 by 8 inches (203 by 203 mm).
b. Pictogram: None.
c. Copy: Tactile and Braille.
d. Character Size: As indicated. Not less than 5/8 inch (15.9 mm) high and not more than 2 inches (51 mm) high.
e. Text/Message: "EXIT STAIR DOWN".
f. Location: Wall, at each exit door that leads to a grade-level exterior exit by means of a stairway and where indicated.

C. Field-Applied, Vinyl Signs:

1. Accessible Entrance Identification Sign: Where it is not practical to place a wall mounted accessible entrance identification panel sign because all the adjacent surfaces are glass, provide a sign fabricated from opaque nonreflective vinyl film, not less than 3.5 mil (0.089 mm) nominal thickness, with pressure-sensitive adhesive backing suitable for both exterior and interior applications.

    a. Approximate Sign Size: 8 by 8 inches (203 by 203 mm).
    b. Pictogram: International Symbol of Accessibility
    c. Location: All building entrances that are accessible to and useable by persons with disabilities and where indicated.
    d. International Symbol of Accessibility: The international Symbol of Accessibility shall comply with CBC Figure 11B-703.7.2.1. The symbol shall consist of a white figure on a blue background. The color blue shall approximate FS 15090 in Federal Standard 595C per CBC Section 11B-703.7.2.1.

        1) The appropriate enforcement agency may approve other colors provided the symbol contrast is light on dark or dark on light.

D. Signage shown on Drawings not listed in sign schedule shall be fabricated to the same standards, using the same materials, and shall be dimensionally and visually consistent with the signs listed in the sign schedule.

END OF SECTION 101423

This page intentionally left blank.

SECTION 101426 - POST AND PANEL/PYLON SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Nonilluminated post-and-panel signs.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for temporary Project identification signs and for temporary informational and directional signs.
2. Section 033000 "Cast-in-Place Concrete" for concrete foundations, concrete fill in postholes, and setting anchor bolts in concrete foundations for signs.
3. Section 101423 "Panel Signage" for wall-mounted sign panels.

1.3 DEFINITIONS

A. Illuminated: Illuminated by lighting source integrally constructed as part of the sign unit.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For post-and-panel signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign not less than half size.

C. Samples for Verification: For each type of sign assembly, showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Post-and-Panel Signs: Full-size Sample of each post-and-panel sign type.
2. Exposed Accessories: Full-size Sample of each accessory type.
3. Full-size Samples, if approved, will be returned to Contractor for use in Project.

D. Product Schedule: For post-and-panel signs. Use same designations indicated on Drawings or post-and-panel sign schedule.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer of products or an entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify locations of post-and-panel signs and indicate measurements on Shop Drawings.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of graphic image.
c. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACCESSIBILITY REQUIREMENTS

A. Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

B. Visual Characters: Visual characters shall comply with CBC Section 11B-703.5 per CBC Section 11B-703.5.

1. Exception: Where visual characters comply with CBC Section 11B-703.2 and are accompanied by Braille complying with CBC Section 11B-703.3, they shall not be required to comply with CBC Sections 11B-703.5.2 through 11B-703.5.6, 11B-703.5.8 and 11B-703.5.9.
2. Finish and Contrast: Characters and their background shall have a non-glare finish. Characters shall contrast with their background with either light characters on a dark background or dark characters on a light background per CBC Section 11B-703.5.1.

3. Case: Characters shall be uppercase or lowercase or a combination of both per CBC Section 11B-703.5.2.
4. Style: Characters shall be conventional in form. Characters shall not be italic, oblique, script, highly decorative, or of other unusual forms per CBC Section 11B-703.5.3.
5. Character Proportions: Characters shall be selected from fonts where the width of the uppercase letter "O" is 60 percent minimum and 110 percent maximum of the height of the uppercase letter "I" per CBC Section 11B-703.5.4.
6. Character Height: Minimum character height shall comply with CBC Table 11B-703.5.5. Viewing distance shall be measured as the horizontal distance between the character and an obstruction preventing further approach towards the sign. Character height shall be based on the height of the uppercase letter "I" per CBC Section 11B-703.5.5.

    a. Exception: Where provided, floor plans providing emergency procedures information in accordance with Title 19 shall not be required to comply with CBC Section 11B-703.5.5.

7. Height from Finish Floor or Ground: Visual characters shall be 40 inches (1016 mm) minimum above the finish floor or ground per CBC Section 11B-703.5.6.

    a. Exceptions:

        1) Visual characters indicating elevator car controls shall not be required to comply with CBC Section 11B-703.5.6.
        2) Floor-level exit signs complying with CBC Chapter 10, Section 1013.7 shall not be required to comply with CBC Section 11B-703.5.6.
        3) Where provided, floor plans providing emergency procedures information in accordance with Title 19 shall not be required to comply with CBC Section 11B-703.5.6.

8. Stroke Thickness: Stroke thickness of the uppercase letter "I" shall be 10 percent minimum and 20 percent maximum of the height of the character per CBC Section 11B-703.5.7.
9. Character Spacing: Character spacing shall be measured between the two closest points of adjacent characters, excluding word spaces. Spacing between individual characters shall be 10 percent minimum and 35 percent maximum of the character height per CBC Section 11B-703.5.8.
10. Line Spacing: Spacing between the baselines of separate lines of characters within a message shall be 135 percent minimum and 170 percent maximum of the character height per CBC Section 11B-703.5.9.
11. Format: Text shall be in a horizontal format per CBC Section 11B-703.5.10.

C. Parking Spaces:

1. General: Car and van parking spaces shall comply with CBC Section 11B-502. Where parking spaces are marked with lines, width measurements of parking spaces and access aisles shall be made from the centerline of the markings per CBC Section 11B-502.1.

    a. Exception: Where parking spaces or access aisles are not adjacent to another parking space or access aisle, measurements shall be permitted to include the full width of the line defining the parking space or access aisle.

2. Identification: Parking space identification signs shall include the International Symbol of Accessibility complying with CBC Section 11B-703.7.2.1 in white on a blue background. Signs identifying van parking spaces shall contain additional language or an additional sign with the designation "VAN ACCESSIBLE". Signs shall be 60 inches (1524 mm) minimum above the finish floor or ground surface measured to the bottom of the sign per CBC Section 11B-502.6.

a. Exception: Signs located within a circulation path shall be a minimum of 80 inches (2032 mm) above the finish floor or ground surface measured to the bottom of the sign.
b. Finish and Size: Parking identification signs shall be reflectorized with a minimum area of 70 square inches (45,161 square mm) per CBC Section 11B-502.6.1.
c. Minimum Fine: Additional language or an additional sign below the International Symbol of Accessibility shall state "MINIMUM FINE $250" per CBC Section 11B-502.6.2.
d. Location: A parking space identification sign shall be visible from each parking space. Signs shall be permanently posted either immediately adjacent to the parking space or within the projected parking space width at the head of the parking space. Signs may also be permanently posted on a wall at the interior end of the parking space per CBC Section 11B-502.6.3 and CBC Figure 11B-502.3.3.

3. Additional Signs: An additional sign shall be posted either; 1) in a conspicuous place at each entrance to an off-street parking facility or 2) immediately adjacent to on-site accessible parking and visible from each parking space per CBC Section 11B-502.8.

a. Size: The additional sign shall not be less than 17 inches (432 mm) wide by 22 inches (559 mm) high per CBC Section 11B-502.8.1.
b. Lettering: The additional sign shall clearly state in letters with a minimum height of 1 inch (25 mm) the following per CBC 11B-502.8.2:

1) "UNAUTHORIZED VEHICLES PARKED IN DESIGNATED ACCESSIBLE SPACES NOT DISPLAYING DISTINGUISHING PLACARDS OR SPECIAL LICENSE PLATES ISSUED FOR PERSONS WITH DISABILITIES WILL BE TOWED AWAY AT THE OWNER'S EXPENSE. TOWED VEHICLES MAY BE RECLAIMED AT _____ OR BY TELEPHONING _____."
2) Blank spaces shall be filled in with appropriate information as a permanent part of the sign.

2.2 PERFORMANCE REQUIREMENTS

A. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.3 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Regional Materials: Post-and-panel/pylon signage shall be manufactured within 500 miles (800 km) of Project site.

2.4 POST-AND-PANEL SIGNS

A. Post-and-Panel Signs: Signs of single-panel configuration; with smooth, uniform surfaces and support assembly; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. ACE Sign Systems, Inc.
    b. Allen Industries Architectural Signage.
    c. APCO Graphics, Inc.
    d. ASI Sign Systems, Inc.
    e. Bunting Graphics, Inc.
    f. Charleston Industries, Inc.
    g. Clarke Systems.
    h. Diskey Architectural Signage Inc.
    i. Fossil Industries, Inc.
    j. Nelson-Harkins Industries.
    k. Poblocki Sign Company, LLC.
    l. Signs & Decal Corp.
    m. Stamprite Supersine; a division of Stamp Rite Inc.
    n. Vista System.
    o. Vomar Products, Inc.

2. Solid-Sheet Sign Panels: Aluminum sheet with finish specified in "Sign-Panel-Face Finish and Applied Graphics" Subparagraph and as follows:

    a. Thickness: Manufacturer's standard for size of sign but not less than 0.0808 inch (2.05 mm) (12 gage nominal).
    b. Surface-Applied Graphics: Applied paint.
    c. Edge Condition: Square cut.
    d. Corner Condition in Elevation: Rounded to radius indicated on Drawings or, if not indicated, 1/2 inch (12.70 mm).
    e. Sign-Panel-Back Finish: Mill.

3. Sign-Frame Mounting: On posts.
4. Posts: Steel.

    a. Shape: Round or square.
    b. Size: 2 inch (50 mm) diameter or 2 by 2 inches (50 by 50 mm).

        1) Note: Manufacturer’s standard 2 pounds per linear foot "U-channel" hot-dip galvanized posts may be used in lieu of round or square steel tubing when approved by Architect.

    c. Installation Method: Direct burial.
    d. Finish and Color: As fabricated.

5. Sign-Panel-Face Finish and Applied Graphics:

    a. Integral Aluminum Finish: As fabricated.
    b. Finish and Graphics: Manufacturer's standard, factory-applied, reflectorized finish, in colors indicated or, if not indicated, as selected by Architect from manufacturer's full range.

        1) Yellow: Color shall match Color No. 13538 in Federal Standard 595C.
        2) White: Color shall match Color No. 17875 in Federal Standard 595C.
        3) Red: Color shall match Color No. 21105 in Federal Standard 595C.
        4) Green: Color shall match Color No. 14109 in Federal Standard 595C.

5) Blue: Color shall match Color No. 15090 in Federal Standard 595C.

a) Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

6) Black: Color shall match Color No. 17038 in Federal Standard 595C.

6. Text and Typeface: Arial unless otherwise indicated.
7. Text: As indicated on Drawings.

2.5 MATERIALS

A. Aluminum Sheet and Plate: ASTM B209 (ASTM B209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

B. Steel Materials:

1. Steel Tubing or Pipe: ASTM A500/A500M, Grade B.
2. For steel exposed to view on completion, provide materials having flat, smooth surfaces without blemishes. Do not use materials whose surfaces exhibit pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Reflective Vinyl Film: UV-resistant reflective vinyl film of nominal thickness indicated or manufacturer's standard thickness, with pressure-sensitive, permanent adhesive on back; and suitable for exterior applications.

D. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.6 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following unless otherwise indicated:

1. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.

2.7 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

B. Sign Message Panels: Construct sign-panel surfaces to be smooth and to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner.

1. Increase panel thickness or reinforce with concealed stiffeners or backing materials as needed to produce surfaces without distortion, buckles, warp, or other surface deformations.

C. Post Fabrication: Fabricate posts of lengths required for installation method indicated for each sign.

1. Steel Posts: Fabricate from not less than 0.120 inch (3.05 mm) thick, steel tubing or pipe unless otherwise indicated. Include post caps, fillers, spacers, reinforcement where required for loading conditions, and related accessories required for complete installation.

    a. Hot-dip galvanize post assemblies after fabrication according to ASTM A123/A123M.

2. Direct Burial: Fabricate posts 36 inches (910 mm) longer than height of sign to permit direct burial or embedment in concrete foundations or concrete-filled postholes.

2.8 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SIGN LOCATIONS

A. Sign locations shown on Drawings are for code compliance only. Contractor shall arrange a meeting with the Architect, Owner’s Representative, Inspector, and all other concerned parties at the site to review and approve precise final locations.

3.3 INSTALLATION

A. General: Install signs using installation methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign components are clean and free of materials or debris that would impair installation.

4. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.

3.4 INSTALLING POSTS

A. Vertical Tolerance: Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).

B. Direct-Burial Method:

1. Excavation: Excavate posthole to dimensions indicated. Reconstruct subgrade that is not firm, undisturbed, or compacted soil, or that is damaged by freezing temperatures, frost, rain, accumulated water, or construction activities by excavating an additional 12 inches (300 mm), backfilling with satisfactory soil or well-graded aggregate, and compacting to original subgrade elevation.
2. Setting in Cast-in-Place Concrete: Set post in position, support to prevent movement, and place concrete in posthole as indicated on Drawings.

3.5 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

3.6 POST-AND-PANEL SIGN SCHEDULE

A. Entrance to Off-Street Parking Facilities Sign: Comply with the following:

1. Sign Size: Not less than 24 by 24 inches (600 by 600 mm) or as required to fit required text.
2. Pictogram: None.
3. Text/Message: "UNAUTHORIZED VEHICLES PARKED IN DESIGNATED ACCESSIBLE SPACES NOT DISPLAYING DISTINGUISHING PLACARDS OR SPECIAL LICENSE PLATES ISSUED FOR PERSONS WITH DISABILITIES WILL BE TOWED AWAY AT THE OWNER'S EXPENSE. TOWED VEHICLES MAY BE RECLAIMED AT _____ OR BY TELEPHONING _____."

    1) Blank spaces shall be filled in with required information as a permanent part of the sign.
    2) Owner will provide required information.

4. Character Size: Not less than 1 inch (25 mm) high.
5. Location: At each entrance to an off-street parking facility and where indicated.
6. Color: The sign shall consist of white characters on a blue background. The blue shall be Color No. 15090 in Federal Standard 595B.

B. Standard Accessible Parking Space Sign Type 1: Comply with the following:

1. Sign Size: Not less than 12 by 12 inches (300 by 300 mm).
2. Pictogram: International Symbol of Accessibility.
3. Text/Message: None.
4. Location: At each standard accessible parking space and where indicated.
5. International Symbol of Accessibility: The International Symbol of Accessibility shall comply with CBC Figure 11B-703.7.2.1. The symbol shall consist of a white figure on a blue background. The blue shall be Color No. 15090 in Federal Standard 595B per CBC Section 11B-703.7.2.1.
6. Color: The sign shall consist of white characters on a blue background. The blue shall be Color No. 15090 in Federal Standard 595B.

C. Standard Accessible Parking Space Sign Type 2: Comply with the following:

1. Sign Size: Not less than 12 by 18 inches (300 by 450 mm).
2. Pictogram: International Symbol of Accessibility.
3. Text/Message: "MINIMUM FINE $250".

    a. Note: Providing a standard accessible parking space sign with the text/message "MINIMUM FINE $250" located below the International Symbol of Accessibility in lieu of providing a separate sign with the text/message "MINIMUM FINE $250" located below a standard accessible parking space sign with the International Symbol of Accessibility is considered equivalent facilitation.

4. Character Size: Not less than 1 inch (25 mm) high.
5. Location: At each standard accessible parking space and where indicated.
6. International Symbol of Accessibility: The International Symbol of Accessibility shall comply with CBC Figure 11B-703.7.2.1. The symbol shall consist of a white figure on a blue background. The blue shall be Color No. 15090 in Federal Standard 595B per CBC Section 11B-703.7.2.1.
7. Color: The sign shall consist of white characters on a blue background. The blue shall be Color No. 15090 in Federal Standard 595B.

D. Van Accessible Parking Space Sign Type 1: Conform to the following:

1. Sign Size: Not less than 12 by 6 inches (300 by 150 mm) or as required to fit required text.
2. Pictogram: None.
3. Text/Message: "VAN ACCESSIBLE".

    a. Note: Provide a van accessible parking space sign below a standard accessible parking space sign.

4. Character Size: Not less than 1 inch (25 mm) high.
5. Location: At each van accessible parking space and where indicated.
6. Color: The sign shall consist of white characters on a blue background. The blue shall be Color No. 15090 in Federal Standard 595B.

E. Van Accessible Parking Space Sign Type 2: Conform to the following:

1. Sign Size: 12 by 18 inches (300 by 450 mm).
2. Pictogram: International Symbol of Accessibility.
3. Text/Message 1: "VAN ACCESSIBLE".

a. Note: Providing a single van accessible parking space sign with the text/message "VAN ACCESSIBLE" located below the International Symbol of Accessibility in lieu of providing a separate sign with the text/message "VAN ACCESSIBLE" located below a standard accessible parking space sign with the International Symbol of Accessibility is considered equivalent facilitation.

4. Character Size: Not less than 1 inch (25 mm) high.
5. Location: At each van accessible parking space and where indicated.
6. International Symbol of Accessibility: The International Symbol of Accessibility shall comply with CBC Figure 11B-703.7.2.1. The symbol shall consist of a white figure on a blue background. The blue shall be Color No. 15090 in Federal Standard 595B per CBC Section 11B-703.7.2.1.
7. Color: The sign shall consist of white characters on a blue background. The blue shall be Color No. 15090 in Federal Standard 595B.

F. Van Accessible Parking Space Sign Type 3: Conform to the following:

1. Sign Size: 12 by 24 inches (300 by 600 mm).
2. Pictogram: International Symbol of Accessibility.
3. Text/Message 1: "VAN ACCESSIBLE".
4. Text/Message 2: "MINIMUM FINE $250".

a. Note: Providing a single van accessible parking space sign with the text/message "MINIMUM FINE $250" located below the text/message "VAN ACCESSIBLE" located below the International Symbol of Accessibility in lieu of providing a separate sign with the text/message "MINIMUM FINE $250" located below a separate sign with the text/message "VAN ACCESSIBLE" located below a standard accessible parking space sign with the International Symbol of Accessibility is considered equivalent facilitation.

5. Character Size: Not less than 1 inch (25 mm) high.
6. Location: At each van accessible parking space and where indicated.
7. International Symbol of Accessibility: The International Symbol of Accessibility shall comply with CBC Figure 11B-703.7.2.1. The symbol shall consist of a white figure on a blue background. The blue shall be Color No. 15090 in Federal Standard 595B per CBC Section 11B-703.7.2.1.
8. Color: The sign shall consist of white characters on a blue background. The blue shall be Color No. 15090 in Federal Standard 595B.

G. Minimum Fine Sign: Comply with the following:

1. Sign Size: Not less than 12 by 6 inches (300 by 150 mm) or as required to fit required text.
2. Pictogram: None.
3. Text/Message: "MINIMUM FINE $250".

a. Note: Provide a minimum fine sign below a standard accessible parking space sign and below a van accessible parking space sign.

4. Character Size: Not less than 1 inch (25 mm) high.
5. Location: At each standard accessible parking space, van accessible parking space, and where indicated.
6. Color: The sign shall consist of white characters on a blue background. The blue shall be Color No. 15090 in Federal Standard 595B.

H. Accessible Path of Travel Sign: Conform to the following:

1. Sign Size: 12 by 18 inches (300 by 450 mm).
2. Pictogram: International Symbol of Accessibility and directional arrow.
3. Text/Message: None or as indicated.
4. Character Size: As indicated. Not less than 5/8 inch (15.9 mm) high and not more than 2 inches (51 mm) high.
5. Location: As indicated.
6. Quantity: As indicated.
7. Text Color: White.
8. International Symbol of Accessibility and Directional Arrow Color: White.
9. Background Color: Blue equal to Color No. 15090 in Federal Standard 595B.

I. Fire Lane Sign: Conform to the following:

1. Sign Size: 12 by 18 inches (300 by 450 mm).
2. Pictogram: None.
3. Text/Message: "FIRE LANE NO PARKING" or as indicated.
4. Character Size: As indicated. Not less than 5/8 inch (15.9 mm) high and not more than 2 inches (51 mm) high.
5. Location: As indicated.
6. Quantity: As indicated.
7. Text Color: Red.
8. Background Color: White.

J. Signage shown on Drawings not listed in sign schedule shall be fabricated to the same standards, using the same materials, and shall be dimensionally and visually consistent with the signs listed in the sign schedule.

END OF SECTION 101426

This page intentionally left blank.

SECTION 102113.17 - PHENOLIC-CORE TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Phenolic-core toilet compartments configured as toilet enclosures and urinal screens.

B. Related Requirements:

1. Section 054000 "Cold-Formed Metal Framing" for metal backing for anchoring toilet enclosures.
2. Section 092216 "Non-Structural Metal Framing" for metal backing for anchoring toilet enclosures.
3. Section 102800 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories mounted on toilet compartments.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings: For toilet compartments.

1. Include plans, elevations, sections, details, and attachment details.
2. Show locations of cutouts for compartment-mounted toilet accessories.
3. Show locations of reinforcements for compartment-mounted grab bars.
4. Show locations of centerlines of toilet fixtures.
5. Show locations of floor drains.

C. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:

1. Each type of material, color, and finish required for toilet compartments, prepared on 6 inch (152 mm) square Samples of same thickness and material indicated for Work.
2. Each type of hardware and accessory.

D. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of toilet compartment.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

1.7 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace components of toilet compartments that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Deterioration of metals, metal finishes, panels, panel finishes, and other materials beyond normal weathering.
c. Failure of operating components.

2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACCESSIBILITY REQUIREMENTS

A. Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

B. Toilet compartments indicated to be accessible to people with disabilities shall comply with applicable requirements of the CBC and the 2010 ADA Standards for Accessible Design.

C. Toilet Compartments: Where toilet compartments are provided, at least five percent of the toilet compartments, or five percent of the combination of toilet compartments and urinals, but no fewer than one toilet compartment shall comply with CBC Section 11B-604.8.1. In addition to the compartments required to comply with CBC Section 11B-604.8.1, where six or more toilet compartments are provided, or where the combination of urinals and water closets totals six or more fixtures, toilet compartments complying with CBC Section 11B-604.8.2 shall be provided in the same quantity as the toilet compartments required to comply with CBC Section 11B-604.8.1 per CBC Section 11B-213.3.1.

D. Coat Hooks and Shelves: Where coat hooks or shelves are provided in toilet rooms without toilet compartments, at least one of each type shall comply with CBC Section11B-603.4. Where coat hooks or

shelves are provided in toilet compartments, at least one of each type complying with CBC Section11B-604.8.3 shall be provided in toilet compartments required to comply with CBC Section 11B-213.3.1. Where coat hooks or shelves are provided in bathing facilities, at least one of each type complying with CBC Section11B-603.4 shall serve fixtures required to comply with CBC Section 11B-213.3.6.

E. Doors, Doorways, and Gates:

1. General: Doors, doorways, and gates that are part of an accessible route shall comply with CBC Section 11B-404 per CBC Section 11B-404.1.
2. Manual Doors, Doorways, and Manual Gates: Manual doors and doorways and manual gates intended for user passage shall comply with CBC Section 11B-404.2 per CBC Section 11B-404.2.

a. Clear Width: Openings shall provide a clear width of 32 inches (813 mm) minimum. Clear openings of doorways with swinging doors shall be measured between the face of the door and the stop, with the door open 90 degrees. Openings more than 24 inches (610 mm) deep shall provide a clear opening of 36 inches (914 mm) minimum. There shall be no projections into the required clear opening width lower than 34 inches (864 mm) above the finish floor or ground. Projections into the clear opening width between 34 inches (864 mm) and 80 inches (2032 mm) above the finish floor or ground shall not exceed 4 inches (102 mm) per CBC Section 11B-404.2.3 and CBC Figure 11B-404.2.3.

b. Maneuvering Clearances: Minimum maneuvering clearances at doors and gates shall comply with CBC Section 11B-404.2.4. Maneuvering clearances shall extend the full width of the doorway and the required latch side or hinge side clearance per CBC Section 11B-404.2.4.

1) Swinging Doors and Gates: Swinging doors and gates shall have maneuvering clearances complying with CBC Table 11B-404.2.4.1 per CBC Section 11B-404.2.4.1.
2) Floor or Ground Surface: Floor or ground surface within required maneuvering clearances shall comply with CBC Section 11B-302. Changes in level are not permitted per CBC Section 11B-404.2.4.4.

a) Exception:

1. Slopes not steeper than 1:48 shall be permitted.

c. Door and Gate Hardware: Handles, pulls, latches, locks, and other operable parts on doors and gates shall comply with CBC Section 11B-309.4. Operable parts of such hardware shall be 34 inches (864 mm) minimum and 44 inches (1118 mm) maximum above the finish floor or ground. Where sliding doors are in the fully open position, operating hardware shall be exposed and usable from both sides per CBC Section 11B-404.2.7.

d. Closing Speed: Door and gate closing speed shall comply with CBC Section 11B-404.2.8 per CBC Section 11B-404.2.8.

1) Door Closers and Gate Closers: Door closers and gate closers shall be adjusted so that from an open position of 90 degrees, the time required to move the door to a position of 12 degrees from the latch is 5 seconds minimum per CBC Section 11B-404.2.8.1.
2) Spring Hinges: Door and gate spring hinges shall be adjusted so that from the open position of 70 degrees, the door or gate shall move to the closed position in 1.5 seconds minimum per CBC Section 11B-404.2.8.2.

e. Door and Gate Opening Force: The force for pushing or pulling open a door or gate shall be as follows per CBC Section 11B-404.2.9:

1) Interior Hinged Doors and Gates: 5 pounds (22.2 N) maximum.

F. Water Closets and Toilet Compartments:

1. General: Water closets and toilet compartments shall comply with CBC Sections 11B-604.2 through 11B-604.8 per CBC Section 11B-604.1.

a. Exception: Water closets and toilet compartments for children's use shall be permitted to comply with CBC Section 11B-604.9.

2. Toilet Compartments: Wheelchair accessible toilet compartments shall meet the requirements of CBC Sections 11B-604.8.1 and 11B-604.8.3. Compartments containing more than one plumbing fixture shall comply with CBC Section 11B-603. Ambulatory accessible compartments shall comply with CBC Sections 11B-604.8.2 and 11B-604.8.3 per CBC Section 11B-604.8.

a. Wheelchair Accessible Compartments: Wheelchair accessible compartments shall comply with CBC Section 11B-604.8.1 per CBC Section 11B-604.8.1.

1) Size: Wheelchair accessible compartments shall be 60 inches (1524 mm) wide minimum measured perpendicular to the side wall, and 56 inches (1422 mm) deep minimum for wall hung water closets and 59 inches (1499 mm) deep minimum for floor mounted water closets measured perpendicular to the rear wall. Wheelchair accessible compartments shall additionally provide maneuvering space complying with CBC Section 11B-604.8.1.1.1, 11B-604.1.1.2, or 11B-604.8.1.1.3, as applicable. Wheelchair accessible compartments for children's use shall be 60 inches (1524 mm) wide minimum measured perpendicular to the side wall, and 59 inches (1499 mm) deep minimum for wall hung and floor mounted water closets measured perpendicular to the rear wall per CBC Section 11B-604.8.1.1.

a) Maneuvering Space with In-Swinging Door: In a wheelchair accessible compartment with an in-swinging door, a minimum 60 inches (1524 mm) wide by 36 inches (914 mm) deep maneuvering space shall be provided in front of the clearance required in CBC Section 11B-604.8.1.1 per CBC Section 11B-604.8.1.1.1 and CBC Figures 11B-604.8.1.1.2 (b) and 11B-604.8.1.1.3 (b).
b) Maneuvering Space with Side-Opening Door: In a wheelchair accessible compartment with a door located in the side wall or partition, either in-swinging or out swinging, a minimum 60 inches (1524 mm) wide and 60 inches (1524 mm) deep maneuvering space shall be provided in front of the water closet per CBC Section 11B-604.8.1.1.2 and CBC Figure 11B-604.8.1.1.2.
c) Maneuvering Space with End-Opening Door: In a wheelchair accessible compartment with a door located in the front wall or partition (facing the water closet), either in-swinging or out swinging, a minimum 60 inches (1524 mm) wide and 48 inches (1219 mm) deep maneuvering space shall be provided in front of the water closet per CBC Section 11B-604.8.1.1.3 and CBC Figure 11B-604.8.1.1.3.

2) Doors: Toilet compartment doors, including door hardware, shall comply with CBC Section 11B-404, except that if the approach is from the push side of the compartment door, clearance between the door side of the compartment and any obstruction shall be 48 inches (1219 mm) minimum measured perpendicular to the compartment door in its closed position. Doors shall be located in the front partition or in the side wall or partition farthest from the water closet. Where located in the front partition, the door

opening shall be 4 inches (102 mm) maximum from the side wall or partition farthest from the water closet. Where located in the side wall or partition, the door opening shall be 4 inches (102 mm) maximum from front partition. The door shall be self-closing. A door pull complying with CBC Section 11B-404.2.7 shall be placed on both sides of the door near the latch. Doors shall not swing into the clear floor space or clearance required for any fixture. Doors may swing into that portion of maneuvering space which does not overlap the clearance required at a water closet per CBC Section 11B-604.8.1.2.

a) Exception: When located at the side of a toilet compartment, the toilet compartment door opening shall provide a clear width of 34 inches (864 mm) minimum.
b) Door and Gate Hardware: Handles, pulls, latches, locks, and other operable parts on doors and gates shall comply with CBC Section 11B-309.4. Operable parts of such hardware shall be 34 inches (864 mm) minimum and 44 inches (1118 mm) maximum above the finish floor or ground per CBC Section 11B-404.2.7.
c) Operation: Operable parts shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate operable parts shall be 5 pounds (22.2 N) maximum per CBC Section 11B-309.4.

3) Approach: Compartments shall be arranged for left-hand or right hand approach to the water closet per CBC Section 11B-604.8.1.3.
4) Toe Clearance: At least one side partition shall provide a toe clearance of 9 inches (229 mm) minimum above the finish floor and 6 inches (152 mm) deep minimum beyond the compartment-side face of the partition, exclusive of partition support members. Partition components at toe clearances shall be smooth without sharp edges or abrasive surfaces. Compartments for children's use shall provide a toe clearance of 12 inches (305 mm) minimum above the finish floor per CBC Section 11B-604.8.1.4 and CBC Figure 11B-604.8.1.4.

a) Exception: Toe clearance at the side partition is not required in a compartment greater than 66 inches (1676 mm) wide.

b. Ambulatory Accessible Toilet Compartments: Ambulatory accessible toilet compartments shall comply with CBC Section 11B-604.8.2 and CBC Figure 11B-604.8.2.

1) Size: Ambulatory accessible compartments shall have a depth of 60 inches (1524 mm) minimum and a width of 35 inches (889 mm) minimum and 37 inches (940 mm) maximum per CBC Section 11B-604.8.2.1.
2) Doors: Toilet compartment doors, including door hardware, shall comply with CBC Section 11B-404, except that if the approach is to the latch side of the compartment door, clearance between the door side of the compartment and any obstruction shall be 44 inches (1118 mm) minimum. The door shall be self-closing. A door pull complying with CBC Section 11B-404.2.7 shall be placed on both sides of the door near the latch. Toilet compartment doors shall not swing into the minimum required compartment area per CBC Section 11B-604.8.2.2.

a) Door and Gate Hardware: Handles, pulls, latches, locks, and other operable parts on doors and gates shall comply with CBC Section 11B-309.4. Operable parts of such hardware shall be 34 inches (864 mm) minimum and 44 inches (1118 mm) maximum above the finish floor or ground per CBC Section 11B-404.2.7.

b) Operation: Operable parts shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate operable parts shall be 5 pounds (22.2 N) maximum per CBC Section 11B-309.4.

c. Coat Hooks and Shelves: Coat hooks shall be located within one of the reach ranges specified in CBC Section 11B-308. Shelves shall be located 40 inches (1016 mm) minimum and 48 inches (1219 mm) maximum above the finish floor per CBC Section 11B-604.8.3.

1) Coat hook shall be mounted 48 inches (1219 mm) maximum and 15 inches (381 mm) minimum above the finished floor or ground per CBC Sections 11B-308.2.1 and 11B-308.3.1.

G. Provide "U" shaped wire pulls at all compartments indicated to be accessible to people with disabilities with a minimum projection of 1-1/2 inches (37.5 mm).

2.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 75 or less.
2. Smoke-Developed Index: 450 or less.

2.3 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Recycled Content of Aluminum Products: Recycled content not less than 20 percent.

C. Recycled Content of Stainless-Steel Products: Recycled content not less than 20 percent.

D. Recycled Content of Phenolic-Core Panel Material: Recycled content not less than 20 percent.

2.4 PHENOLIC-CORE TOILET COMPARMENTS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc; 1092.67 Series, Sierra Series, Water- Fire-Resistant, Solid Color Reinforced Composite, Overhead-Braced, Toilet Partitions and Urinal Screens with Institutional Hardware, or a comparable product by one of the following:

1. Accurate Partitions Corp., an ASI Group Company.
2. All American Metal Corp.
3. American Sanitary Partition Corporation.
4. Ampco by AJW.
5. Bradley Corporation.
6. Decolam.
7. Flush Metal Partition, LLC.
8. General Partitions Mfg. Corp.
9. Global Partitions Corp., an ASI Group Company.

10. Knickerbocker Partition Corporation.
11. Marlite.
12. Metpar Corp.
13. Partition Systems International of South Carolina.
14. PSISC.
15. Scranton Products.
16. Spec-Rite Designs, LLC; DesignRite Partitions.
17. Tex-Lam Manufacturing, Inc.
18. Weis-Robart Partitions, Inc.

B. Toilet-Enclosure Style: Overhead braced.

C. Urinal-Screen Style: Wall hung.

D. Door, Panel, and Pilaster Construction: Solid Color Reinforced Composite with GraffitiOff surface, thermoset and integrally fused into one homogeneous piece, and with eased and polished edges. Surface, edge, core are to be the same color. Provide not less than 3/4 inch (19 mm) thick doors and pilasters and not less than 1/2 inch (13 mm) thick panels.

E. Pilaster Shoes: Formed from stainless-steel sheet, not less than 0.031 inch (0.79 mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.

F. Brackets (Fittings):

1. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.

    a. Brackets (fittings) shall be through bolted to panels, screens, and pilasters with stainless steel, tamper resistant through-bolts. Fasten to wall with stainless steel tamper resistant screws.
    b. Provide wall brackets not less than 54 inches (1372 mm) long with fasteners through substrate to backing on both sides of panel unless otherwise indicated.

        1) Provide wall brackets not less than 54 inches (1372 mm) long with fasteners through substrate to backing on one side of panel where face of panel is flush with edge of pilaster.

G. Phenolic-Panel Finish:

1. Facing Sheet Finish: One color and pattern in each room.
2. Color and Pattern: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.
3. Edge Color: Through-color matching facing sheet color.

2.5 HARDWARE AND ACCESSORIES

A. Hardware and Accessories: Manufacturer's heavy-duty operating hardware and accessories.

1. Hinges: Manufacturer's standard design, heavy-duty, stainless-steel, not less than 0.062 inch (1.59 mm) thick, or extruded aluminum, paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees, allowing emergency access by lifting door. Mount with tamper resistant through-bolts.

2. Latch and Keeper: Manufacturer's standard design, heavy-duty, surface-mounted, cast-stainless-steel or extruded aluminum latch unit designed to resist damage due to slamming, with combination rubber-faced door strike and keeper, allowing emergency access by lifting door. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible. Mount with tamper resistant through-bolts.
3. Coat Hook: Manufacturer's standard design, heavy-duty, cast-stainless-steel, combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories. Mount with tamper resistant through-bolts.
4. Door Bumper: Manufacturer's standard design, heavy-duty, cast-stainless-steel, rubber-tipped bumper at out-swinging doors. Mount with tamper resistant through-bolts.
5. Door Pull: Manufacturer's standard design, heavy-duty, cast-stainless-steel, pull. Mount with tamper resistant through-bolts.

    a. Provide units on one side of doors at compartments not indicated to be accessible to people with disabilities.
    b. Provide units on both sides of doors at compartments indicated to be accessible to people with disabilities.
    c. Provide units that comply with regulatory requirements for accessibility.
    d. Provide "U" shaped wire pulls at compartments indicated to be accessible to people with disabilities with a minimum projection of 1-1/2 inches (37.5 mm).

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless-steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.6 MATERIALS

A. Aluminum Extrusions: ASTM B221 (ASTM B221M).

B. Stainless-Steel Sheet: ASTM A666, Type 304, stretcher-leveled standard of flatness.

C. Stainless-Steel Castings: ASTM A743/A743M.

2.7 FABRICATION

A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Door Size and Swings: Unless otherwise indicated, provide 24 inch (610 mm) wide in-swinging doors for standard toilet compartments and 36 inch (914 mm) wide out-swinging doors for compartments designated as accessible.

1. Doors at front entry stalls shall have a clear width of not less than 32 inches (813 mm) when the door is open 90 degrees.
2. Doors at side entry stalls shall have a clear width of not less than 34 inches (864 mm) when the door is open 90 degrees.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.

1. Confirm location and adequacy of blocking and supports required for installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

a. Pilasters and Panels: 1/2 inch (13 mm).
b. Pilasters and Walls: 1 inch (25 mm).
c. Panels and Walls: 1 inch (25 mm).
d. Doors and Pilasters: 1/4 inch (6 mm).
e. Doors and Panels: 1/4 inch (6 mm).

2. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.

a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
b. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches (44 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.3 ADJUSTING

A. Hardware Adjustment:
1. Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation.

2. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched.
3. Set hinges on doors for compartments indicated to be accessible to people with disabilities to return doors to fully closed position when unlatched.

END OF SECTION 102113.17

SECTION 102239 - FOLDING PANEL PARTITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Electrically operated, acoustical panel partitions.

B. Related Requirements:

1. Section 054000 "Cold-Formed Metal Framing" for metal backing required for installing folding panel partitions and concealed within other construction before folding panel partitions installation.
2. Section 055000 "Metal Fabrications" for supports that attach supporting tracks to overhead structural system.
3. Section 092216 "Non-Structural Metal Framing" for metal backing required for installing folding panel partitions and concealed within other construction before folding panel partitions installation.
4. Section 092900 "Gypsum Board" for fire-rated assemblies and sound barrier construction above the ceiling at track.
5. Electrical and communications Sections for electrical service and connections for motor operators, controls, and limit switches and for system disconnect switches.

1.3 DEFINITIONS

A. NIC: Noise Isolation Class.

B. NRC: Noise Reduction Coefficient.

C. STC: Sound Transmission Class.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For operable panel partitions.

1. Include plans, elevations, sections, attachment details, and numbered panel installation sequence.
2. Indicate stacking and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.
3. Include diagrams for power, signal, and control wiring.

C. Samples for Verification: For each type of exposed material, finish, covering, or facing, prepared on Samples of size indicated below:

1. Textile Facing Material: Full width by not less than 36 inch (914 mm) long section of fabric from dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat.
2. Panel Facing Material: Manufacturer's standard-size unit, not less than 3 inches (75 mm) square.
3. Panel Edge Material: Not less than 3 inches (75 mm) long.
4. Hardware: One of each exposed door-operating device.

D. Delegated-Design Submittal: For operable panel partitions.

1. Include design calculations for seismic restraints that brace tracks to structure above.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Partition track, track supports and bracing, switches, turning space, and storage layout.
2. Suspended ceiling components.
3. Structural members to which suspension systems will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. HVAC ductwork, outlets, and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Smoke detectors.
    f. Access panels.

6. Plenum fire, smoke, and acoustical barriers.

B. Setting Drawings: For embedded items and cutouts required in other work, including support-beam, mounting-hole template.

C. Qualification Data: For Installer.

D. Seismic Qualification Certificates: For operable panel partitions, tracks, accessories, and components, from manufacturer. Include seismic capacity of partition assemblies to remain in vertical position during a seismic event and the following:

1. Basis for Certification: Indicate whether certification is based on analysis, testing, or experience data, according to ASCE/SEI 7.
2. Detailed description of partition anchorage devices on which the certification is based and their installation requirements.

E. Product Certificates: For each type of operable panel partition.

F. Product Test Reports: For each operable panel partition, for tests performed by a qualified testing agency.

G. Sample Warranty: For manufacturer's special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For operable panel partitions to include in maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Panel finish facings and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
b. Seals, hardware, track, track switches, carriers, and other operating components.
c. Electric operator and controls.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Panel Finish-Facing Material: Furnish full width in quantity to cover both sides of two panels when installed.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Protectively package and sequence panels in order for installation. Clearly mark packages and panels with numbering system used on Shop Drawings. Do not use permanent markings on panels.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty operation of operable panel partitions.
b. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACCESSIBILITY REQUIREMENTS

A. Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

B. Reach Ranges:

1. General: Reach ranges shall comply with CBC Section 11B-308 per CBC Section 11B-308.1.

C. Operable Parts:

1. General: Operable parts shall comply with CBC Section 11B-309 per CBC Section 11B-309.1.
2. Operation: Operable parts shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate operable parts shall be 5 pounds (22.2 N) maximum per CBC Section 11B-309.4.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design seismic bracing of tracks to structure above.

B. Seismic Performance: Operable panel partitions shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the partition panels will remain in place without separation of any parts when subjected to the seismic forces specified."

C. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties according to test methods indicated:

1. Sound-Transmission Requirements: Operable panel partition assembly tested for laboratory sound-transmission loss performance according to ASTM E90, determined by ASTM E413, and rated for not less than the STC indicated.

D. Fire-Test-Response Characteristics: Provide panels with finishes complying with one of the following as determined by testing identical products by a testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

2. Fire Growth Contribution: Complying with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Recycled Content of Aluminum Products: Recycled content not less than 20 percent.

C. Recycled Content of Steel Products: Recycled content not less than 20 percent.

D. Finish Material Pollutant Control: Finish materials shall comply with CGBC Sections 5.504.4.1 through 5.504.4.6 per CGBC Section 5.504.4.

1. Adhesives, Sealants, and Caulks: Adhesives, sealants, and caulks used on the project shall meet the requirements of the following standards per CGBC Section 5.504.4.1:

a. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in CBC Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products specified in subparagraph below.
b. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

2. Adhesives shall comply with maximum VOC limits listed in CGBC Table 5.504.4.1.

E. VOC Content: Adhesives shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Other Adhesive Not Specifically listed: 50 g/L.

F. Low-Emitting Materials: Adhesives shall comply with the requirements of authorities having jurisdiction.

2.4 OPERABLE ACOUSTICAL PANELS

A. Operable Acoustical Panels: Partition system, including panels, seals, finish facing, suspension system, operators, and accessories.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Hufcor, Inc; Series 641, or a comparable product by one of the following:

a. Advanced Equipment Corporation.
b. KWIK-WALL Company.
c. Moderco Inc.
d. Modernfold, Inc.
e. Panelfold Inc.

B. Panel Operation: Manually operated, omni-directional panels.

C. Panel Construction: As required to support panel from suspension components and with reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.

D. Dimensions: Fabricate operable acoustical panel partitions to form an assembled system of dimensions indicated and verified by field measurements.

1. Panel Width: Equal widths. Not more than 48 inches (1219 mm).

E. STC: Not less than 55.

F. Panel Weight: Not more than 12.9 lb/sq. ft. (63 kg/sq. m).

G. Panel Thickness: Not less than 4 inches (102 mm).

H. Panel Materials:

1. Steel Frame: Steel sheet, manufacturer's standard, not less than 0.0598 inch (1.52 mm) nominal thickness (16 gage nominal) for uncoated steel.
2. Steel Face/Liner Sheets: Tension-leveled steel sheet, manufacturer's standard, not less than 0.0359 inch (0.91 mm) nominal thickness (20 gage nominal) for uncoated steel.
3. Gypsum Board: ASTM C1396/C1396M.

a. Thickness: 1/2 inch (12.7 mm).

I. Panel Closure: Manufacturer's standard unless otherwise indicated.

1. Initial Closure: Resilient, bulb-shaped acoustical seal.
2. Final Closure: Constant-force, lever-operated mechanical closure expanding from panel edge to create a constant-pressure acoustical seal.

J. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.

1. Hinges: Manufacturer's standard.

K. Finish Facing: Steel dry-erase markerboards.

2.5 SEALS

A. Description: Seals that produce operable panel partitions complying with performance requirements and the following:

1. Manufacturer's standard seals unless otherwise indicated.
2. Seals made from materials and in profiles that minimize sound leakage.
3. Seals fitting tight at contact surfaces and sealing continuously between adjacent panels and between operable panel partition perimeter and adjacent surfaces, when operable panel partition is extended and closed.

B. Vertical Seals: Deep-nesting, interlocking astragals mounted on each edge of panel, with continuous, resilient acoustical seal.

C. Horizontal Top Seals: Resilient, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on track when extended.

1. Mechanically Operated for Acoustical Panels: Extension and retraction of bottom seal by operating handle or built-in operating mechanism, with operating range not less than 1 inch (25 mm) between retracted seal and track.

a. Retractable seals shall be activated by a removable quick-set operating handle and top and bottom seal shall be operated simultaneously.

D. Horizontal Bottom Seals: Resilient, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on floor when extended, ensuring horizontal and vertical sealing and resisting panel movement.

1. Mechanically Operated for Acoustical Panels: Extension and retraction of bottom seal by operating handle or built-in operating mechanism, with operating range not less than 2 inches (50 mm) between retracted seal and floor finish.

a. Retractable seals shall be activated by a removable quick-set operating handle and top and bottom seal shall be operated simultaneously.

2.6 PANEL FINISH FACINGS

A. Description: Finish facings for panels that comply with indicated fire-test-response characteristics and that are factory applied to operable panel partitions with appropriate backing, using mildew-resistant nonstaining adhesive as recommended by facing manufacturer's written instructions.

B. Steel Dry-Erase Markerboards: Provide steel dry-erase markerboards on both sides of every panel unless otherwise indicated.

1. Surface Color: White.
2. Size: Full height and width of panel.

C. Paint: Manufacturer's standard factory-painted finish.

1. Color: White.

2.7 SUSPENSION SYSTEMS

A. Tracks: Steel or aluminum with adjustable steel hanger rods for overhead support, designed for operation, size, and weight of operable panel partition indicated. Size track to support partition operation and storage without damage to suspension system, operable panel partitions, or adjacent construction. Limit track deflection to not more than 0.10 inch (2.54 mm) between bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.

1. Panel Guide: Aluminum guide on both sides of the track to facilitate straightening of the panels; finished with factory-applied, decorative, protective finish.
2. Head Closure Trim: As required for acoustical performance; with factory-applied, decorative, protective finish.

B. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.

C. Track Intersections, Switches, and Accessories: As required for operation, storage, track configuration, and layout indicated for operable panel partitions, and compatible with partition assembly specified. Fabricate track intersections and switches from steel or aluminum.

D. Aluminum Finish: Mill finish or manufacturer's standard, factory-applied, decorative finish unless otherwise indicated.

E. Steel Finish: Manufacturer's standard, factory-applied, corrosion-resistant, protective coating unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine flooring, floor levelness, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with ASTM E 557, operable partition manufacturer's written installation instructions, Drawings and approved Shop Drawings.

B. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed in area of partition installation.

C. Install panels in numbered sequence indicated on Shop Drawings.

D. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.

E. Broken, cracked, deformed, or unmatched gasketing or gasketing with gaps at butted ends is not acceptable.

F. Light-Leakage Test: Illuminate one side of partition installation and observe vertical joints and top and bottom seals for voids. Adjust partitions for alignment and full closure of vertical joints and full closure along top and bottom seals. Perform test and make adjustments before NIC testing.

3.3 FIELD QUALITY CONTROL

A. NIC Testing: Owner will engage a qualified testing agency to perform tests and inspections.

1. Testing Extent: Testing agency shall test all operable panel partition installations.
2. Testing Methodology: Perform testing of installed operable panel partition for noise isolation according to ASTM E336, determined by ASTM E413, and rated for not less than NIC indicated. Adjust and fit partitions to comply with NIC test method requirements.

B. An operable panel partition installation will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust operable panel partitions, hardware, and other moving parts to function smoothly, and lubricate as recommended by manufacturer.

B. Verify that safety devices are properly functioning.

3.5 MAINTENANCE SERVICE

A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months full maintenance by manufacturer's authorized service representative. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operable-partition operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain operable panel partitions.

END OF SECTION 102239

This page intentionally left blank.

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Underlavatory guards.
3. Custodial accessories.

B. Related Requirements:

1. Section 088300 "Mirrors" for frameless mirrors.

1.3 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

B. Samples for Verification: When requested, provide full size, for each accessory and for each finish specified to verify design, operation, and finish requirements.

1. Approved full-size Samples will be returned and may be used in the Work.
2. Samples must be in an undamaged condition at time of use.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify accessories using designations indicated.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.7 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, visible silver spoilage defects.
2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 OWNER-FURNISHED MATERIALS

1. Owner may furnish some or all toilet, bath, and laundry accessories at his option for installation by the Contractor.
2. All Owner-furnished material shall comply with the CBC, the ADAAG, and the requirements of this section.
3. Installation of all Owner-Furnished material shall comply with the CBC, the ADAAG, and the requirements of this section.

2.2 ACCESSIBILITY REQUIREMENTS

A. Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

B. Mirrors: Where mirrors are provided, at least one shall comply with CBC Section 11B-603.3 per CBC Section 11B-213.3.5.

C. Coat Hooks and Shelves: Where coat hooks or shelves are provided in toilet rooms without toilet compartments, at least one of each type shall comply with CBC Section11B-603.4. Where coat hooks or shelves are provided in toilet compartments, at least one of each type complying with CBC Section11B-604.8.3 shall be provided in toilet compartments required to comply with CBC Section 11B-213.3.1. Where coat hooks or shelves are provided in bathing facilities, at least one of each type complying with CBC Section11B-603.4 shall serve fixtures required to comply with CBC Section 11B-213.3.6.

D. Protruding Objects:

1. General: Protruding objects shall comply with CBC Section 11B-307 per CBC Section 11B-307.1.
2. Protrusion Limits: Objects with leading edges more than 27 inches (686 mm) and not more than 80 inches (2032 mm) above finish floor or ground shall protrude 4 inches (102 mm) maximum horizontally into the circulation path per CBC Section 11B-307.2 and CBC Figure 11B-307.2.

E. Reach Ranges:

1. General: Reach ranges shall comply with CBC Section 11B-308 per CBC Section 11B-308.1.

F. Operable Parts:

1. General: Operable parts shall comply with CBC Section 11B-309 per CBC Section 11B-309.1.
2. Operation: Operable parts shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate operable parts shall be 5 pounds (22.2 N) maximum per CBC Section 11B-309.4.

G. Toilet and Bathing Rooms:

1. General: Toilet and bathing rooms shall comply with CBC Section 11B-603 per CBC Section 11B-603.1.
2. Mirrors: Mirrors located above lavatories or countertops shall be installed with the bottom edge of the reflecting surface 40 inches (1016 mm) maximum above the finish floor or ground. Mirrors not located above lavatories or countertops shall be installed with the bottom edge of the reflecting surface 35 inches (889 mm) maximum above the finish floor or ground per CBC Section 11B-603.3.
3. Coat Hooks, Shelves, and Medicine Cabinets: Coat hooks shall be located within one of the reach ranges specified in CBC Section 11B-308. Shelves shall be located 40 inches (1016 mm) minimum and 48 inches (1219 mm) maximum above the finish floor. Medicine cabinets shall be located with a useable shelf no higher than 44 inches (1118 mm) maximum above the finish floor per CBC Section 11B-603.4.
4. Accessories: Where towel or sanitary napkin dispensers, waste receptacles, or other accessories are provided in toilet facilities, at least one of each type shall be located on an accessible route. All operable parts, including coin slots, shall be 40 inches (1016 mm) maximum above the finish floor per CBC Section 11B-603.5.

    a. Exception: Baby changing tables are not required to comply with Section 11B-603.5.

H. Water Closets and Toilet Compartments:

1. General: Water closets and toilet compartments shall comply with CBC Sections 11B-604.2 through 11B-604.8 per CBC Section 11B-604.1.
2. Grab Bars for Water Closets: Grab bars for water closets shall comply with CBC Section 11B-609. Grab bars shall be provided on the side wall closest to the water closet and on the rear wall. Where separate grab bars are required on adjacent walls at a common mounting height, an L-shaped grab bar meeting the dimensional requirements of CBC Sections 11B-604.5.1 and 11B-604.5.2 shall be permitted per CBC Section 11B-604.5.

    a. Side Wall: The side wall grab bar shall be 42 inches (1067 mm) long minimum, located 12 inches (305 mm) maximum from the rear wall and extending 54 inches (1372 mm) minimum from the rear wall with the front end positioned 24 inches (610 mm) minimum in front of the water closet per CBC Section 11B-604.5.1 and CBC Figure 11B-604.5.1.
    b. Rear Wall: The rear wall grab bar shall be 36 inches (914 mm) long minimum and extend from the centerline of the water closet 12 inches (305 mm) minimum on one side and 24 inches

(610 mm) minimum on the other side per CBC Section 11B-604.5.2 and CBC Figure 11B-604.5.2.

3. Dispensers: Toilet paper dispensers shall comply with CBC Section 11B-309.4 and shall be 7 inches (178 mm) minimum and 9 inches (229 mm) maximum in front of the water closet measured to the centerline of the dispenser. The outlet of the dispenser shall be below the grab bar, 19 inches (483 mm) minimum above the finish floor and shall not be located behind grab bars. Dispensers shall not be of a type that controls delivery or that does not allow continuous paper flow per CBC Section 11B-604.7 and CBC Figure 11B-604.7.

I. Lavatories and Sinks:

1. General: Lavatories and sinks shall comply with CBC Section 11B-606 per CBC Section 11B-606.1.
2. Exposed Pipes and Surfaces: Water supply and drain pipes under lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under lavatories and sinks per CBC Section 11B-606.5.

J. Shower Compartments:

1. General: Shower compartments shall comply with CBC Section 11B-608 per CBC Section 11B-608.1.
2. Grab Bars: Grab bars shall comply with CBC Section 11B-609 and shall be provided in accordance with CBC Section 11B-608.3. Where multiple grab bars are used, required horizontal grab bars shall be installed at the same height above the finish floor. Where separate grab bars are required on adjacent walls at a common mounting height, an L-shaped or U-shaped grab bar meeting the dimensional requirements of CBC Section 11B-608.3.2 or 11B-608.3.3 shall be permitted per CBC Section 11B-608.3.

    a. Standard Roll-In Type Shower Compartments: Grab bars shall be provided on the back wall and the side wall opposite the seat. Grab bars shall not be provided above the seat. Grab bars shall be installed 6 inches (152 mm) maximum from adjacent walls per CBC Section 11B-608.3.2 and CBC Figure 11B-608.3.2.
    b. Alternate Roll-In Type Shower Compartments: In alternate roll-in type shower compartments, grab bars shall be provided on the back wall and the side wall farthest from the compartment entry. Grab bars shall not be provided above the seat. Grab bars shall be installed 6 inches (152 mm) maximum from adjacent walls per CBC Section 11B-608.3.3 and CBC Figure 11B-608.3.3.

3. Seats: A folding seat shall be provided in roll-in type showers. Seats shall comply with CBC Section 11B-610 per CBC Section 11B-608.4.
4. Soap Dish for Shower Compartments: Where a soap dish is provided, it shall be located on the control wall at 40 inches (1016 mm) maximum above the shower floor, and within the reach limits from the seat per CBC Section 11B-608.10.

K. Grab Bars:

1. General: Grab bars in toilet facilities and bathing facilities shall comply with CBC Section 11B-609 per CBC Section 11B-609.1.
2. Cross Section: Grab bars shall have a cross section complying with CBC Section 11B-609.2.1 or 11B-609.2.2 per CBC Section 11B-609.2.

a. Circular Cross Section: Grab bars with circular cross sections shall have an outside diameter of 1-1/4 inches (32 mm) minimum and 2 inches (51 mm) maximum per CBC Section 11B-609.2.1.
b. Non-Circular Cross Section: Grab bars with non-circular cross sections shall have a cross-section dimension of 2 inches (51 mm) maximum and a perimeter dimension of 4 inches (102 mm) minimum and 4.8 inches (122 mm) maximum per CBC Section 11B-609.2.2 and CBC Figure 11B-609.2.2.

3. Grab Bars: Spacing: The space between the wall and the grab bar shall be 1-1/2 inches (38 mm). The space between the grab bar and projecting objects below and at the ends shall be 1-1/2 inches (38 mm) minimum. The space between the grab bar and projecting objects above shall be 12 inches (305 mm) minimum per CBC Section 11B-609.3 and CBC Figure 11B-609.3.

   a. Exceptions:

      1) The space between the grab bars and shower controls, shower fittings, and other grab bars above shall be permitted to be 1-1/2 inches (38 mm) minimum.
      2) For L-shaped or U-shaped grab bars complying with CBC Section 11B-609.9 the space between the walls and grab bar shall be 1-1/2 inches (38 mm) minimum for a distance of 6 inches on either side of the inside corner between two adjacent surfaces.

4. Position of Grab Bars: Grab bars shall be installed in a horizontal position, 33 inches (838 mm) minimum and 36 inches (914 mm) maximum above the finish floor measured to the top of the gripping surface, except that at water closets for children's use complying with CBC Section 11B-604.9, grab bars shall be installed in a horizontal position 18 inches (457 mm) minimum and 27 inches (686 mm) maximum above the finish floor measured to the top of the gripping surface. The height of the lower grab bar on the back wall of a bathtub shall comply with CBC Section 11B-607.4.1.1 or 11B-607.4.2.1 per CBC Section 11B-609.4.
5. Surface Hazards: Grab bars and any wall or other surfaces adjacent to grab bars shall be free of sharp or abrasive elements and shall have rounded edges per CBC Section 11B-609.5.
6. Fittings: Grab bars shall not rotate within their fittings per CBC Section 11B-609.6.
7. Installation: Grab bars shall be installed in any manner that provides a gripping surface at the specified locations and that does not obstruct the required clear floor space per CBC Section 11B-609.7.
8. Structural Strength: Allowable stresses shall not be exceeded for materials used when a vertical or horizontal force of 250 pounds (1112 N) is applied at any point on the grab bar, fastener, mounting device, or supporting structure per CBC Section 11B-609.8.
9. Alternate Configuration: L-shaped or U-shaped grab bars shall be permitted per CBC Section 11B-609.9.

L. Seats:

1. General: Seats in bathtubs and shower compartments shall comply with CBC Section 11B-610 per CBC Section 11B-610.1.
2. Shower Compartment Seats: A seat in a standard roll-in shower compartment shall be a folding type, shall be installed on the side wall adjacent to the controls, and shall extend from the back wall to a point within 3 inches (76 mm) of the compartment entry. A seat in an alternate roll-in type shower compartment shall be a folding type, shall be installed on the front wall opposite the back wall, and shall extend from the adjacent side wall to a point within 3 inches (76 mm) of the compartment entry. The top of the seat shall be 17 inches (432 mm) minimum and 19 inches (483 mm) maximum above the bathroom the finish floor. When folded, the seat shall extend 6 inches (152 mm) maximum from the mounting wall. Seats shall comply with CBC Section 11B-610.3.1 or 11B-610.3.2 per CBC Section 11B-610.3 and CBC Figure 11B-610.3.

a. Rectangular Seats: The rear edge of a rectangular seat shall be 2-1/2 inches (64 mm) maximum and the front edge 15 inches (381 mm) minimum and 16 inches (406 mm) maximum from the seat wall. The side edge of the seat shall be 1-1/2 inches (38 mm) maximum from the adjacent wall per CBC Section 11B-610.3.1 and CBC Figure 11B-610.3.1.
b. L-Shaped Seats: The rear edge of an L-shaped seat shall be 2-1/2 inches (64 mm) maximum and the front edge 15 inches (381 mm) minimum and 16 inches (406 mm) maximum from the seat wall. The rear edge of the "L" portion of the seat shall be 1-1/2 inches (38 mm) maximum from the wall and the front edge shall be 14 inches (356 mm) minimum and 15 inches (381 mm) maximum from the wall. The end of the "L" shall be 22 inches (559 mm) minimum and 23 inches (584 mm) maximum from the main seat wall per CBC Section 11B-610.3.2 and CBC Figure 11B-610.3.2.

3. Structural Strength: Allowable stresses shall not be exceeded for materials used when a vertical or horizontal force of 250 pounds (1112 N) is applied at any point on the seat, fastener, mounting device, or supporting structure per CBC Section 11B-610.4.

M. Toilet tissue dispensers, seat cover dispensers, sanitary-napkin vendors, and sanitary-napkin disposal units located on the grab bar side of an accessible toilet room or stall shall not project more than 3 inches (76.2 mm) from the finished wall surface.

2.3 PUBLIC-USE WASHROOM ACCESSORIES

A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.

B. Public-Use Washroom Accessories:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. AJW Architectural Products.
b. American Specialties, Inc.
c. Bobrick Washroom Equipment, Inc.
d. Bradley Corporation.
e. Brey-Krause Manufacturing Co.
f. GAMCO Specialty Accessories; a division of Bobrick.
g. Tubular Specialties Manufacturing, Inc.

2.4 UNDERLAVATORY GUARDS

A. Source Limitations: Obtain underlavatory guards from single source from single manufacturer.

B. Underlavatory Guards:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Plumberex Specialty Products, Inc.
b. Truebro by IPS Corporation.

2. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
3. Material and Finish: Antimicrobial, molded plastic, white.

2.5 CUSTODIAL ACCESSORIES

A. Source Limitations: Obtain custodial accessories from single source from single manufacturer.

B. Custodial Accessories:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. AJW Architectural Products.
b. American Specialties, Inc.
c. Bobrick Washroom Equipment, Inc.
d. Bradley Corporation.
e. Brey-Krause Manufacturing Co.
f. GAMCO Specialty Accessories; a division of Bobrick.
g. Tubular Specialties Manufacturing, Inc.

2.6 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, not less than 0.031 inch (0.8 mm) nominal thickness, 22 gage, unless otherwise indicated.

B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), not less than 0.036 inch (0.9 mm) nominal thickness, 20 gage, unless otherwise indicated.

D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.

E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.7 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide not less than six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mirrors located above lavatories or countertops shall be installed with the bottom edge of the reflecting surface not more than 40 inches (1016 mm) above the finish floor.

B. Mirrors not located above lavatories or countertops shall be installed with the bottom edge of the reflecting surface not more than 35 inches (889 mm) above the finish floor.

C. Where towel dispensers, sanitary napkin dispensers, waste receptacles, or other accessories are provided in toilet facilities, at least one of each type shall be located on an accessible route.

1. All operable parts, including coin slots, shall be not more than 40 inches (1016 mm) above the finish floor.

D. The space between grab bars and projecting objects below and at the ends shall be not less than 1-1/2 inches (32 mm).

E. The space between grab bars and projecting objects above shall be not less than 12 inches (305 mm).

F. Grab bars shall not rotate within their fittings.

G. Allowable stresses shall not be exceeded for materials used when a vertical or horizontal force of 250 pounds (1112 N) is applied at any point on the grab bar, fastener, mounting device, or supporting structure.

H. Toilet and bath accessories shall not project more than 4 inches (101.6 mm) into the path of travel.

I. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

J. Grab Bars: Install to withstand a downward load of not less than 250 lbf (1112 N), when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION 102800

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire-protection cabinets for the following:

a. Portable fire extinguisher.

B. Related Requirements:

1. Section 09 22 16 "Non-Structural Metal Framing" for metal backing for anchoring fire-protection cabinets.
2. Section 104416 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets

1.3 UNIT PRICES

A. Work of this Section is affected by Unit Price 1.

B. Work of this Section is affected by Unit Price 2.

1.4 PREINSTALLATION CONFERENCE

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to fire-protection cabinets, including, but not limited to, the following:

a. Schedules and coordination requirements.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.

B. Shop Drawings: For fire-protection cabinets.

1. Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Verification: For each type of exposed finish required, prepared on samples 6 inches (150 mm) square.

D. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.7 COORDINATION

A. Coordinate minimum quantity and location of fire protection cabinets and type and capacity of fire extinguishers required with Fire Marshall or authorities having jurisdiction.

B. Coordinate quantity and location of fire protection cabinets and type and capacity of fire extinguishers required by Owner in addition to those required by Fire Marshall or authorities having jurisdiction with Owner's representative.

C. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

D. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 ACCESSIBILITY REQUIREMENTS

A. Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

B. Protruding Objects:

1. General: Protruding objects shall comply with CBC Section 11B-307 per CBC Section 11B-307.1.

2. Protrusion Limits: Objects with leading edges more than 27 inches (686 mm) and not more than 80 inches (2032 mm) above finish floor or ground shall protrude 4 inches (102 mm) maximum horizontally into the circulation path per CBC Section 11B-307.2 and CBC Figure 11B-307.2.

C. Reach Ranges:

1. General: Reach ranges shall comply with CBC Section 11B-308 per CBC Section 11B-308.1.

D. Operable Parts:

1. General: Operable parts shall comply with CBC Section 11B-309 per CBC Section 11B-309.1.
2. Operation: Operable parts shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate operable parts shall be 5 pounds (22.2 N) maximum per CBC Section 11B-309.4.

2.3 PERFORMANCE REQUIREMENTS

A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

2.4 NONRATED SEMIRECESSED FIRE-PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.

1. Basis-of-Design Product: Subject to compliance with requirements, provide JL Industries, Inc.; a division of the Activar Construction Products Group; Cosmopolitan Stainless Steel Fire Extinguisher Cabinet, Model Number 1730S21, or a comparable product by one of the following:

a. Babcock-Davis.
b. Fire-End & Croker Corporation.
c. GMR International Equipment Corporation.
d. Guardian Fire Equipment, Inc.
e. Larsens Manufacturing Company.
f. Modern Metal Products, Division of Technico Inc.
g. MOON American.
h. Nystrom, Inc.
i. Potter Roemer LLC.
j. Strike First Corporation of America (The).

B. Cabinet Construction: Nonrated.

C. Cabinet Material: Cold-rolled steel sheet.

D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).

1. Square-Edge Trim: 2-1/4 inch (57 mm) backbend depth.
2. Provide nonrated semirecessed fire-protection cabinet unless otherwise indicated.
3. Fire protection cabinets shall not project more than 4 inches (101.6 mm) into the path of travel.

E. Cabinet Trim Material: Stainless-steel sheet.

F. Door Material: Stainless-steel sheet.

G. Door Style: Flush (solid) opaque panel, frameless.

H. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide projecting door pull and friction latch.

a. Accessible door-operating hardware shall comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

I. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.

a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."

1) Location: Applied to cabinet door.
2) Application Process: Pressure-sensitive vinyl letters.
3) Lettering Color: Red.
4) Orientation: Vertical.

J. Materials:

1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.

a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
b. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
c. Color: White unless otherwise indicated.

2. Stainless Steel: ASTM A666, Type 304.

a. Finish: No. 4 directional satin finish.

2.5 FIRE-RATED SEMIRECESSED FIRE-PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.

1. Basis-of-Design Product: Subject to compliance with requirements, provide JL Industries, Inc.; a division of the Activar Construction Products Group; Cosmopolitan Stainless Steel FX2 Fire Extinguisher Cabinet, Model Number 1730S21FX2, or a comparable product by one of the following:

    a. Babcock-Davis.
    b. Fire-End & Croker Corporation.
    c. GMR International Equipment Corporation.
    d. Guardian Fire Equipment, Inc.
    e. Larsens Manufacturing Company.
    f. Modern Metal Products, Division of Technico Inc.
    g. MOON American.
    h. Nystrom, Inc.
    i. Potter Roemer LLC.
    j. Strike First Corporation of America (The).

B. Cabinet Construction: One-hour fire rated unless otherwise indicated.

1. Fire-Resistance Rating: Not less than that of adjacent construction.
2. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from not less than 0.043 inch (1.09 mm) thick cold-rolled steel sheet lined with not less than 5/8 inch (16 mm) thick fire-barrier material. Provide factory-drilled mounting holes.

C. Cabinet Material: Cold-rolled steel sheet.

D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).

1. Square-Edge Trim: 2-1/4 inch (57 mm) backbend depth.
2. Provide fire-rated semirecessed fire-protection cabinet where required and where indicated on Drawings.
3. Fire protection cabinets shall not project more than 4 inches (101.6 mm) into the path of travel.

E. Cabinet Trim Material: Stainless-steel sheet.

F. Door Material: Stainless-steel sheet.

G. Door Style: Flush (solid) opaque panel, frameless.

H. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide projecting door pull and friction latch.

    a. Accessible door-operating hardware shall comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

I. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.

    a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."

        1) Location: Applied to cabinet door.
        2) Application Process: Pressure-sensitive vinyl letters.
        3) Lettering Color: Red.
        4) Orientation: Vertical.

J. Materials:

1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.

    a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
    b. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
    c. Color: White unless otherwise indicated.

2. Stainless Steel: ASTM A666, Type 304.

    a. Finish: No. 4 directional satin finish.

2.6 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Miter corners and grind smooth.
3. Provide factory-drilled mounting holes.
4. Prepare doors and frames to receive pulls and latches.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, not less than 1/2 inch (13 mm) thick.
2. Fabricate door frames of one-piece construction with edges flanged.
3. Miter and weld perimeter door frames and grind smooth.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire-protection cabinets in locations indicated by Fire Marshall or authorities having jurisdiction and in locations indicated by Owner's representative. Install fire-protection cabinets at mounting heights indicated, at mounting heights acceptable to Fire Marshall or authorities having jurisdiction, and in compliance with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

1. Fire-Protection Cabinets for Fire Extinguishers Weighing Not More Than 40 lb (18 kg): Not more than 48 inches (1219 mm) above finished floor to top of fire extinguisher.
2. Fire-Protection Cabinets for Fire Extinguishers Weighing More Than 40 lb (18 kg): Not more than 42 inches (1067 mm) above finished floor to top of fire extinguisher.

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

1. Unless otherwise indicated, provide semirecessed fire-protection cabinets.
2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
3. Fire protection cabinets shall not project more than 4 inches (101.6 mm) into the path of travel.

C. Identification:

1. Apply vinyl lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral latching devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes portable, hand-carried fire extinguishers.

B. Related Requirements:

1. Section 104413 "Fire Protection Cabinets."

1.3 UNIT PRICES

A. Work of this Section is affected by Unit Price No. 3.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to fire extinguishers including, but not limited to, the following:

a. Schedules and coordination requirements.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher.

B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.8 COORDINATION

A. Coordinate minimum quantity and location of fire protection cabinets and type and capacity of fire extinguishers required with Fire Marshall or authorities having jurisdiction.

B. Coordinate quantity and location of fire protection cabinets and type and capacity of fire extinguishers required by Owner in addition to those required by Fire Marshall or authorities having jurisdiction with Owner's representative.

C. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10 when testing interval required by NFPA 10 is within the warranty period.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.

2.2 ACCESSIBILITY REQUIREMENTS

A. Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

B. Protruding Objects:

1. General: Protruding objects shall comply with CBC Section 11B-307 per CBC Section 11B-307.1.
2. Protrusion Limits: Objects with leading edges more than 27 inches (686 mm) and not more than 80 inches (2032 mm) above finish floor or ground shall protrude 4 inches (102 mm) maximum horizontally into the circulation path per CBC Section 11B-307.2 and CBC Figure 11B-307.2.

C. Reach Ranges:

1. General: Reach ranges shall comply with CBC Section 11B-308 per CBC Section 11B-308.1.

D. Operable Parts:

1. General: Operable parts shall comply with CBC Section 11B-309 per CBC Section 11B-309.1.
2. Operation: Operable parts shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate operable parts shall be 5 pounds (22.2 N) maximum per CBC Section 11B-309.4.

2.3 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.4 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet indicated.

1. Basis-of-Design Product: Subject to compliance with requirements, provide JL Industries, Inc.; a division of the Activar Construction Products Group; Galaxy 5 Fire Extinguisher, or a comparable product by one of the following:

    a. Amerex Corporation.
    b. Ansul; Tyco Fire Protection Products.
    c. Babcock-Davis.
    d. Badger Fire Protection.
    e. Buckeye Fire Equipment Company.
    f. Fire End & Croker Corporation.
    g. Guardian Fire Equipment, Inc.
    h. Kidde Residential and Commercial Division.
    i. Larsens Manufacturing Company.
    j. MOON American.
    k. Nystrom, Inc.
    l. Oval Fire Products Corporation.
    m. Potter Roemer LLC.
    n. Pyro-Chem; Tyco Fire Suppression & Building Products.
    o. Strike First Corporation of America (The).

2. Valves: Manufacturer's standard.
3. Handles and Levers: Manufacturer's standard.
4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type: UL-rated 2-A:10-B:C, 5 lb (2.3 kg) nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers in locations indicated by Fire Marshall or authorities having jurisdiction and in locations indicated by Owner's representative. Install fire extinguishers at mounting heights indicated, at mounting heights acceptable to Fire Marshall or authorities having jurisdiction, and in compliance with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

1. Fire Extinguishers Weighing Not More Than 40 lb (18 kg): Not more than 48 inches (1219 mm) above finished floor to top of fire extinguisher.
2. Fire Extinguishers Weighing More Than 40 lb (18 kg): Not more than 42 inches (1067 mm) above finished floor to top of fire extinguisher.

END OF SECTION 104416

SECTION 107113.43 - FIXED SUN SCREENS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Provide fixed custom sunshades as shown on the drawings, as specified and as needed for a complete and proper installation.

1. The drawings show the extent of the work, the dimensioned profile and depth of the sunshade to be provided.

1.02 SUBMITTALS

A. Product Data:

1. Submit specifications, data and installation instructions from the manufacturer of the sunshades.

B. Shop Drawings:

1. Include elevations, sections and specific details for each sunshade.
2. Show anchorage details and connections for all component parts.
3. Include signed and sealed structural calculations.

C. Samples:

1. Submit one sample not less than 24 inches (610 mm) long of each material to be utilized at each sunshade with specified finish.

D. Warranty:

1. Provide written warranty to the owner that all products will be free of defective materials or workmanship for a period of one year from date of installation.

1.03 QUALITY ASSURANCE

A. Manufacturer: Firm that has not less than ten years experience in the design and manufacturing of work similar to that shown and required.

B. Performance:

1. Design sunshades to accommodate local requirements for wind loading. Provide engineering calculations to support design. Calculations to be by a registered engineer licensed in the state the project is located. Analysis to include all components of sunshade including, but not limited to, deflection of blades, outriggers and fascia. Deflection to be limited to L/120, 3/4 inch (19 mm), or as required by code.

C. Professional Engineer: Drawings and structural calculations to be signed and sealed by a professional engineer licensed to practice in the project state.

D. Warranty: Provide written warranty to the owner that all products will be free of defective materials or workmanship for a period of one year from date of installation.

1.04 DELIVERY, STORAGE AND HANDLING

A. Delivery: At the time of delivery all materials shall be visually inspected for damage. Any damaged boxes, crates, sunshade sections, etc. shall be noted on the receiving ticket and immediately reported to the shipping company and the material manufacturer.

B. Storage:

1. Material may be stored flat, on end or on its side.
2. Material may be stored either indoors or outdoors.
3. If stored outdoors the material must be raised sufficiently off the ground to prevent it being flooded.
4. If stored outdoors the material must be covered with a weather proof flame resistant sheeting or tarpaulin.

C. Handling:

1. Material shall be handled in accordance with sound material handling practices and in such a way as to minimize racking.

1.05 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sunshades that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including, but not limited to, excessive deflection.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: One year from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain all components of sunshades, including accessories, from single manufacturer.

2.02 SUNSHADES - TYPE SS-1

A. CS 200-4 Horizontal Sunshades.

1. Blades: 12 inches (305 mm) high, extruded aluminum airfoil design. Blades shall be attached to perimeter frame using stainless steel, type F, thread cutting screws through internal screw slots in blades. Welding is not acceptable. Blades to be mechanically secured to allow for replacement in case of damage. Fasteners to be hex head.
2. Mounting Bracket:

a. Aluminum mounting bracket, by sunshade manufacturer. All fasteners mounting to structure to be designed and supplied by sunshade manufacturer. Fasteners to be stainless steel 300 Series.

3. Exterior Finish: Three-coat fluoropolymer.

a. Color: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

2.03 MATERIALS

A. Aluminum Extrusions: ASTM B211, Alloy 6063-T5, 6063-T6 or 6061-T6.

B. Fasteners: Fasteners shall be stainless steel. Provide types, gauges and lengths to suit unit installation conditions.

C. Anchors and Inserts: Use stainless steel anchors and inserts for installation and elsewhere as required for corrosion resistance. Use stainless steel or lead expansion bolt devices for drill in place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.04 FABRICATION, GENERAL

A. Provide fixed sunshades and accessories materials, sizes, depths, arrangements and material thickness to be as indicated or as required for optimal performance with respect to strength; durability; and uniform appearance.

B. Include supports, anchorage, and accessories required for complete assembly.

2.05 FINISHES

A. General: Comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations, except as otherwise indicated. Apply finishes in factory. Protect finishes on exposed surfaces prior to shipment. Remove scratches and blemishes from exposed surfaces that will be visible after completing finishing process.

B. Three Coat Fluorocarbon Coating

1. Sunshades to be finished with not less than 1.4 mil (0.035 mm) thick full strength 70 percent resin, three-coat fluoropolymer system.
2. All aluminum shall be thoroughly cleaned, etched and given a chromated conversion pre-treatment before application of the Kynar/Hylar coating. The coating shall consist of a primer, a high Metallic color coat and a clear PVF2 topcoat. It shall receive a bake cycle of 17 minutes at 450 deg F. All finishing procedures shall be one continuous operation in the plant of the manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine openings to receive the work. Do not proceed until any unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with manufacturer's instructions and recommendations for installation of the work.

B. Verify dimensions of supporting structure at the site by accurate field measurements so that the work will be accurately designed, fabricated and fitted to the structure.

C. Anchor sunshades to the building substructure as indicated on architectural drawings.

D. Erection Tolerances:

1. Maximum variation from plane or location shown on the approved shop drawings: 1/8 inch in 12 feet (3.2 mm in 3.6 m), but not more than 1/2 inch (13 mm) in any total building length or portion thereof (non-cumulative).
2. Maximum offset from true alignment between two members abutting end to end, edge-to-edge in line or separated by less than 3 inches (76 mm): 1/16 inch (1.6 mm) (shop or field joints). This limiting condition shall prevail under both load and no load conditions.

E. Cut and trim component parts during erection only with the approval of the manufacturer or fabricator, and in accordance with his recommendations. Restore finish completely. Remove and replace members where cutting and trimming has impaired the strength or appearance of the assembly.

F. Do not erect warped, bowed, deformed or otherwise damaged or defaced members. Remove and replace any members damaged in the erection process as directed.

G. Set units level, plumb and true to line, with uniform joints.

3.03 PROTECTION

A. Protect installed materials to prevent damage by other trades. Use materials that may be easily removed without leaving residue or permanent stains.

3.04 ADJUSTING AND CLEANING

A. Immediately clean exposed surfaces of the sunshades to remove fingerprints and dirt accumulation during the installation process. Do not let soiling remain until the final cleaning.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to the material finishes. Thoroughly rinse surfaces and dry.

C. Restore sunshades and accessory components damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by the Architect, remove damaged materials and replace with new materials.

1. Touch up minor abrasions in finishes with a compatible air-dried coating that matches the color and gloss of the factory applied coating.

END OF SECTION 107113.43

This page intentionally left blank.

SECTION 115213 - PROJECTION SCREENS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Electrically operated, front-projection screens and controls.

B. Related Requirements:

1. Section 092216 "Non-Structural Metal Framing" for metal backing required for mounting front-projection screens and concealed within other construction before front-projection screens installation.
2. Electrical Sections for electrical service and connections.

1.3 DEFINITIONS

A. Format: Proportion of projection screen viewing area expressed as a ratio of width/height.

1. Square: 1:1.
2. NTSC or Video Format: 1.33:1 or 4:3.
3. Widescreen Computer Monitor Ratio: 1.60:1 or 16:10.
4. Video Widescreen (HDTV) Format: 1.78:1 or 16:9.
5. Widescreen Standard for Theatrical Film (Letterbox): 1:85:1.
6. 35 mm Anamorphic prior to 1970, used by Cinemascope: 2.35:1.

B. Gain: Ratio of light reflected from screen material to that reflected perpendicularly from a magnesium carbonate surface as determined per SMPTE RP 94.

C. Half-Gain Angle: The angle, measured from the axis of the screen surface to the most central position on a perpendicular plane through the horizontal centerline of the screen where the gain is half of the peak gain.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show layouts and types of front-projection screens. Include the following:

1. Drop lengths.
2. Location of seams in viewing surfaces.

3. Location of screen centerline relative to ends of screen case.
4. Anchorage details, including connection to supporting structure for suspended units.
5. Details of juncture of exposed surfaces with adjacent finishes.
6. Location of wiring connections for electrically operated units.
7. Wiring diagrams for electrically operated units.
8. Accessories.

C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Screen Cases: Set of 6 inch (150 mm) square Samples of each type, color, pattern, and texture of exposed surface.
2. Viewing Surface: Set of 6 inch (150 mm) square Samples of each type, color, and texture.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

C. Certificates: Product certificates signed by manufacturer certifying that materials comply with specified performance characteristics, criteria and physical requirements.

D. Manufacturer’s installation instructions.

E. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For front-projection screens to include in maintenance manuals.

B. Parts catalog that includes complete list of repair and replacement parts, with cuts and identifying numbers.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Manufacturer shall have been producing projection screens identical to that used for this Project for not less than five years.

B. Installer Qualifications:

1. A qualified firm that is approved, authorized, or licensed by projection screen manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
2. Installer shall have not less than five years experience in successfully installing projection screens the same or similar to that used for this Project.
3. The Installer shall be an authorized dealer and service facility for the products specified herein.

4. The Installer shall employ its own installation staff, sub-contracting the work specified herein will not be acceptable.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Environmental Limitations: Do not deliver or install front-projection screens until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Store electric projection screens in a dry, ventilated area, protected from exposure to harmful weather conditions, at a temperature less than 80 deg F (27 deg C).

D. Handle electrically operated projection screen materials with care in order to prevent damage.

1.9 COORDINATION

A. Coordinate layout and installation of front-projection screens with adjacent construction, including ceiling suspension systems, light fixtures, HVAC equipment, fire-suppression system, and partitions.

B. Coordinate requirements for blocking, construction of recesses, and auxiliary structural supports to ensure adequate means for installation of screens.

C. Coordinate installation of recessed mounted screens with construction of suspended ceilings and gypsum board ceilings.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of projection screens that fail in materials or workmanship, not due to abuse, improper use, or care, within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Flaking, peeling, separating, cracking, and change optical characteristics.
b. Not operating smoothly, not stopping consistently without need for adjustment, and noise levels exceeding original noise levels.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Projection Screens: Obtain front-projection screens from single manufacturer. Obtain accessories, including necessary mounting hardware, from screen manufacturer.

2.2 ACCESSIBILITY REQUIREMENTS

A. Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

B. Reach Ranges:

1. General: Reach ranges shall comply with CBC Section 11B-308 per CBC Section 11B-308.1.

C. Operable Parts:

1. General: Operable parts shall comply with CBC Section 11B-309 per CBC Section 11B-309.1.
2. Operation: Operable parts shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate operable parts shall be 5 pounds (22.2 N) maximum per CBC Section 11B-309.4.

2.3 REGULATORY REQUIREMENTS

A. Screen material shall comply with California Code of Regulations, Title 19, Division 1, Chapter 8 - "Regulations Relating to Flame-Retardant Chemicals, Fabrics and Application."

2.4 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Recycled Content of Particleboard: Recycled content not less than 20 percent.

C. Recycled Content of Medium-Density Fiberboard: Recycled content not less than 20 percent.

D. Hardwood Plywood:

1. Composite Wood Products: Hardwood plywood, particleboard and medium density fiberboard composite wood products used on the interior or exterior of the building shall meet the requirements for formaldehyde as specified in California Air Resources Board's (CARB) Air Toxics Control Measure (ATCM) for Composite Wood (17 CCR 93120 et seq.) per CGBC Section 5.504.4.5. Those materials not exempted under ATCM must meet the specified emission limits, as shown in CGBC Table 5.504.4.5.
2. Composite Wood Products: Products shall be made without urea formaldehyde.
3. Hardwood Plywood Veneer Core: Formaldehyde emissions shall not exceed 0.05 ppm per CGBC Table 5.504.4.5.
4. Hardwood Plywood Composite Core: Formaldehyde emissions shall not exceed 0.05 ppm per CGBC Table 5.504.4.5.

E. Particleboard:

1. Composite Wood Products: Hardwood plywood, particleboard and medium density fiberboard composite wood products used on the interior or exterior of the building shall meet the requirements for formaldehyde as specified in California Air Resources Board's (CARB) Air Toxics Control Measure (ATCM) for Composite Wood (17 CCR 93120 et seq.) per CGBC Section 5.504.4.5. Those materials not exempted under ATCM must meet the specified emission limits, as shown in CGBC Table 5.504.4.5.
2. Composite Wood Products: Products shall be made without urea formaldehyde.
3. Formaldehyde emissions shall not exceed 0.09 ppm per CGBC Table 5.504.4.5.

F. Medium-Density Fiberboard:

1. Composite Wood Products: Hardwood plywood, particleboard and medium density fiberboard composite wood products used on the interior or exterior of the building shall meet the requirements for formaldehyde as specified in California Air Resources Board's (CARB) Air Toxics Control Measure (ATCM) for Composite Wood (17 CCR 93120 et seq.) per CGBC Section 5.504.4.5. Those materials not exempted under ATCM must meet the specified emission limits, as shown in CGBC Table 5.504.4.5.
2. Composite Wood Products: Products shall be made without urea formaldehyde.
3. Formaldehyde emissions shall not exceed 0.11 ppm per CGBC Table 5.504.4.5.

G. Finish Material Pollutant Control: Finish materials shall comply with CGBC Sections 5.504.4.1 through 5.504.4.6 per CGBC Section 5.504.4.

1. Adhesives, Sealants, and Caulks: Adhesives, sealants, and caulks used on the project shall meet the requirements of the following standards per CGBC Section 5.504.4.1:

   a. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in CBC Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products specified in subparagraph below.
   b. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

2. Adhesives shall comply with maximum VOC limits listed in CGBC Table 5.504.4.1.

H. VOC Content: Adhesives shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Multipurpose Construction Adhesives: 70 g/L.
2. Structural Wood Member Adhesives: 140 g/L.
3. Wood Glues: 30 g/L.

I. Adhesives: Do not use adhesives that contain urea formaldehyde.

J. Low-Emitting Materials: Adhesives shall comply with the requirements of authorities having jurisdiction.

2.5 ELECTRICALLY OPERATED, FRONT-PROJECTION SCREENS

A. General: Manufacturer's standard units consisting of case, screen, motor, controls, mounting accessories, and other components necessary for a complete installation. Provide units that are listed and labeled as an assembly by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC and NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Controls: Remote, key-operated, three-position control switch installed in recessed device box with flush cover plate matching other electrical device cover plates in room where switch is installed.

    a. Provide one control switch for each screen unless otherwise indicated.
    b. Provide power supply for low-voltage systems if required.
    c. Provide key-operated, power-supply switch.

3. Motor in Roller: Instant-reversing motor of size and capacity recommended by screen manufacturer; with permanently lubricated ball bearings, automatic thermal-overload protection, preset limit switches to automatically stop screen in up and down positions, and positive-stop action to prevent coasting. Mount motor inside roller with vibration isolators to reduce noise transmission.
4. End-Mounted Motor: Instant-reversing, gear-drive motor of size and capacity recommended by screen manufacturer; with permanently lubricated ball bearings, automatic thermal-overload protection, preset limit switches to automatically stop screen in up and down positions, and positive-stop action to prevent coasting. Locate motor in its own compartment on left end of screen unless otherwise indicated.
5. Screen Mounting: Top edge securely anchored to rigid metal roller and bottom edge formed into a pocket holding a 3/8 inch (9.5 mm) diameter metal rod with ends of rod protected by plastic caps.

    a. Roller for end-mounted motor is supported by self-aligning bearings in brackets.
    b. Roller for motor in roller is supported by vibration- and noise-absorbing supports.

B. Suspended, Electrically Operated Screens with Automatic Ceiling Closure, with Motor-in-Roller, and without Tab Tensioning: Units designed and fabricated for suspended mounting; with bottom of case composed of two panels, fully enclosing screen, motor, and wiring; one panel hinged and designed to open and close automatically when screen is lowered and fully raised, the other removable or openable for access to interior of case.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Da-Lite Screen Company; Advantage Deluxe Electrol, or a comparable product by one of the following:

    a. Draper Inc.

2. Provide metal or metal-lined wiring compartment.
3. Screen Case: Made from metal.
4. Provide screen case constructed to be installed with underside flush with ceiling.
5. Finish on Exposed Surfaces: Vinyl covering, baked enamel, or powder coat.

    a. Color: White unless otherwise indicated.

2.6 FRONT-PROJECTION SCREEN MATERIAL

A. Matte-White Viewing Surface: Peak gain of not less than 1.0, and gain of not less than 0.5 at an angle of 60 degrees from the axis of the screen surface.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Da-Lite Screen Company; Matte White, or a comparable product by one of the following:

a. Draper Inc.

B. Material: Vinyl-coated, glass-fiber fabric.

C. Mildew-Resistance Rating: Zero or 1 when tested according to ASTM G21.

D. Flame Resistance: Passes NFPA 701.

E. Flame-Spread Index: Not greater than 75 when tested according to ASTM E84.

F. Seamless Construction: Provide screens, in sizes indicated, without seams.

G. Edge Treatment: Black masking borders.

H. Size of Viewing Surface: 65 by 116 inches (1651 by 2946 mm).

I. Provide extra drop length as needed at top of screen for bottom of screen to be 36 inches (914 mm) above floor unless otherwise indicated.

1. Color: Black.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that condition of substrates previously installed complies with electrically operated projection screen installation requirements.

B. Verify that electrical power supply complies with electrically operated projection screen requirements.

C. Verify type and location of power supply.

D. Inform Architect of unacceptable conditions immediately upon discovery.

E. Proceed with installation only after unacceptable conditions have been corrected.

3.2 INSTALLATION

A. Install front-projection screens at locations indicated to comply with screen manufacturer's written instructions.

1. Comply with manufacturer's written data, including product technical bulletins, product catalog installation instructions, product carton installation instructions and technical data sheets.

B. Install front-projection screens with screen cases in position and in relation to adjoining construction indicated. Securely anchor to supporting substrate in a manner that produces a smoothly operating screen with vertical edges plumb and viewing surface flat when screen is lowered.

1. Install low-voltage controls according to CEC and NFPA 70 and complying with manufacturer's written instructions.

a. Wiring Method: Install wiring in raceway except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use UL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.

2. Switches: Install switches controlling operation of front-projection screens at mounting heights indicated, at mounting heights acceptable to authorities having jurisdiction, and in compliance with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

a. Switches shall be mounted not more than 48 inches (1219 mm) above finish floor or ground.
b. Switches shall be mounted not less than 15 inches (381 mm) above finish floor or ground.

3.3 ADJUSTING

A. Test electrically operated units to verify that screen controls, limit switches, closures, and other operating components are in optimum functioning condition.

1. Operate each screen not less than three times. Ensure screens properly extend and retract and that screen is level and viewing surface plumb when extended. Adjust to correct deficiencies. Verify that the screen operates properly, and that the screen hangs flat without ripples.

B. After installation of hardware, make adjustments and corrections to leave operating parts in perfect condition.

C. Touch-up damaged shop coatings and repair minor damage to eliminate all evidence of repair to the satisfaction of the owner’s representative.

D. Remove and replace work that cannot be satisfactorily repaired

3.4 PROTECTION

A. Protect projection screens from damage resulting from subsequent construction activities. Tape craft paper or other protective membrane over the screen housing opening until directed to remove them. If the protective materials interfere with the operation of the screen, remove power from the unit and document this action with clear and legible labeling.

B. Remove and replace damaged screens.

C. After the building is completely clean and prior to turning over the building to the owner for occupancy, deploy all rollup screens and allow them to hang for at least 72 hours to allow the screen fabric to relax into its

natural flat and smooth shape. Remove any new debris and dust that have accumulated on the screen and exposed housing surfaces. After the 72 hour period, return the screens to the rolled up position.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain front-projection screens.

END OF SECTION 115213

This page intentionally left blank.

SECTION 116143 - STAGE CURTAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Stage curtains.
2. Draw-curtain tracks.
3. Curtain and stage rigging.

B. Related Requirements:

1. Section 051200 "Structural Steel" for steel framing and supports for stage-curtain systems.
2. Section 055000 "Metal Fabrications" for steel framing and supports for stage-curtain systems.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product and the following:

1. Tracks: Capability of each track to support the weight and operation of curtains that it supports.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and attachment details of curtains.
2. Include fabric assembly and hanging details.
3. Dimension operating clearances.
4. Include documentation of capacity of each batten, track, attachment, and rigging component to support loads.

C. Samples for Verification: Full width by not less than 36 inches (900 mm) long section of each fabric from dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat. Mark top and face of fabric.

D. Delegated-Design Submittal: For stage-curtain systems and attachments to structure, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Structural members to which tracks, battens, and other stage-curtain equipment will be attached.
2. Locations of lighting fixtures and cabling, ductwork, piping, and sprinklers.
3. Rigging equipment for stage equipment.
4. Access panels.

B. Qualification Data: For Installer and professional engineer.

C. Product Certificates: For the following, from manufacturer:

1. Fabric: Provide name of flame-retardant chemical used, identification of applicator, treatment method, application date, allowable life span for treatment, and details of any restrictions and limitations.
2. Rigging: Compliance of suspended battens and tracks with requirements.

D. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For stage curtains and rigging to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer of stage curtains.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install stage curtains until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Verify locations of supporting structural elements and construction contiguous with stage curtains and rigging by field measurements before fabrication and indicate measurements on Shop Drawings.

1.9 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of stage-curtain systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, faulty operation of rigging.
2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain stage-curtain systems from single manufacturer. Obtain each color, grade, finish, type, and variety of fabric from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 ACCESSIBILITY REQUIREMENTS

A. Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

2.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stage-curtain systems, including comprehensive engineering analysis and attachments to building structure, using performance requirements.

B. Structural Performance: Stage-curtain systems and attachments to structure shall withstand the effects of gravity and operational loads and the following loads and stresses:

1. Design Loads: Weight of curtains, tracks, and lighting equipment.

C. Fire-Test-Response Characteristics: Provide stage curtains meeting the following requirements as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Flame-Propagation Resistance: Passes NFPA 701.
2. Comply with requirements of State of California, Code of Regulations, Title 19, Public Safety, Division 1.
3. Comply with requirements of California State Fire Marshall, Chapter 8, Regulations Relating to Flame-Retardant Chemicals, Fabrics, and Application Concerns, Article 8.

    a. Permanently attach label to each fabric of curtain assembly indicating whether fabric is inherently and permanently flame resistant or is treated with flame-retardant chemicals and whether it requires retreatment after cleaning or after a designated time period of use.
    b. Permanently attach 12 inch (300 mm) square swatch of same fabric and dye lot for each fabric of a curtain assembly to the back of assembly for use as fire-resistance test strip.

2.4 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

2.5 STAGE-CURTAIN SYSTEMS

A. Description: Complete stage-curtain systems, including stage curtains, tracks, draw-curtain machines, and rigging; with necessary accessories for support and operation.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Black Sheep Enterprises.
b. Georgia Stage, Inc.
c. iWeiss Theatrical Solutions.
d. Janson Industries.
e. LimeLight Productions, Inc.
f. LuXout Stage Curtains; a division of The Specialty Group.
g. Mainstage Theatrical Supply, Inc.
h. NorthEast Stage.
i. Rose Brand.
j. S&K Theatrical Draperies, Inc.
k. Sew What? Inc.
l. Show Works.
m. Stage Decoration & Supplies, Inc.
n. Stagecraft Industries, Inc.
o. Syracuse Scenery & Stage Lighting Co., Inc.
p. Texas Scenic Company, Inc.
q. Tru-Roll, Inc.

2.6 CURTAIN FABRICS

A. General: Provide fabrics inherently and permanently flame resistant or chemically flame resistant by immersion treatment according to performance requirements indicated. Provide fabrics of each type and color from same dye lot.

B. Heavyweight Woven Cotton Velour: Napped fabric of 100 percent cotton weighing not less than 25 oz./linear yd. (775 g/linear m), with pile height not less than 79 mils (2 mm), and width not less than 54 inches (1372 mm).

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Dazian LLC.
b. Frankel/Fabric One.
c. JB Martin Company.
d. KM Fabrics, Inc.
e. Valley Forge Fabrics, Inc.

2. Color: Black.

2.7 CURTAIN FABRICATION

A. General: Affix permanent label, stating compliance with requirements of authorities having jurisdiction, in accessible location on fabric not visible to audience. Provide vertical seams unless otherwise indicated.

Arrange vertical seams so they do not fall on faces of pleats. Do not use fabric cuts less than one-half width. Orient velour fabric with the fabric nap down.

B. Vertical and Top Hems: Machine sew hems as follows unless otherwise indicated:

1. Vertical Hems: Not less than 2 inches (50 mm) wide, with not less than a 1 inch (25 mm) tuck and with no selvage material visible from front of curtain. Sew open ends of hems closed.
2. Turnbacks: Provide leading- and trailing-edge turnbacks for traveler curtains, formed by folding back not less than 12 inches (300 mm) of face fabric, with not less than a 1 inch (25 mm) tuck, and vertically secured by sewing.
3. Top Hems: Reinforced by double-stitching 3-1/2 inch (89 mm) wide, heavy, jute or laminated synthetic webbing to top edge on back side of curtain with not less than 2 inches (50 mm) of face fabric turned under.

C. Fullness:

1. Flat: Provide zero percent fullness in curtains.

D. Grommets: Brass, No. 3, or No. 4.

1. Black Curtains: Provide brass or aluminum grommets with black finish.
2. Flat Curtains: Place 12 inches (300 mm) o.c. and 1 inch (25 mm) from corner of curtain; for ties, snap hooks, or S-hooks.

E. Bottom Hems: Machine sew hems as follows unless otherwise indicated:

1. For Flat Curtains Without Fullness: 4 inch (100 mm) lined hem with pocket for sliding pipe or conduit weight and stiffener into bottom of curtain.

a. Curtains That Do Not Hang to Floor: Hems 1 inch (25 mm) above finished floor.

2.8 CURTAIN ACCESSORIES

A. S-Hooks: Manufacturer's standard heavy-duty plated-wire hooks, not less than 2 inches (50 mm) long.

2.9 ALUMINUM CURTAIN TRACK

A. Aluminum Track: Extruded aluminum, ASTM B221 (ASTM B221M); alloy and temper as recommended by manufacturer for strength and corrosion resistance; black paint finish; complete with necessary accessories for support and operation.

1. Basis-of-Design Product: Subject to compliance with requirements, provide H & H Specialties Inc; 316WB, or a comparable product by one of the following:

a. Automatic Devices Company.
b. Tru-Roll, Inc.

2. Curved Track: Fabricate curved portions of track in shop.
3. Cable Guides for Curved Track: Outside idlers, mule pulleys, spindles, and guides; quantity sufficient for configuration of curve(s) and length of track.

4. Aluminum Thickness: As recommended by manufacturer for loads and operation but not less than 0.125 inch (3.1 mm).

B. Curtain Rails: Single or double curtain capacity as indicated. Provide end stops for track rails.

C. Curtain Carriers: Standard carriers with a pair of nylon- or neoprene-tired ball-bearing wheels riveted parallel to plated-steel body. Equip carriers with rubber or neoprene bumpers and nylon glide strips to reduce noise, and heavy-duty, plated-steel swivel eye for attaching curtain snap or S-hook. Provide quantity of curtain carriers sufficient for track length, to suit curtain fabrication.

1. Master Curtain Carriers: One master carrier, for each curtain edge, with two pairs of nylon- or neoprene-tired ball-bearing wheels riveted parallel to plated-steel body.

D. Curved-Suspended-Track Stiffener: NPS 1-1/2 (DN 40) steel pipe for supporting both sections of suspended curved tracks; curved to match track.

E. Clamp and Bracket Hangers: Steel clamps and brackets of sufficient strength required to support loads for attaching track to overhead support.

F. Manual Walk-Along Operation: Fabricate curtain track without cord, cable, pulleys, or floor pulley.

2.10 CURTAIN AND STAGE RIGGING

A. Battens: Fabricated from steel pipe with a minimum number of joints. Connect pipe at joints with a drive-fit pipe sleeve not less than 18 inches (450 mm) long, and secure with four flush rivets, plug welds, threaded couplings, or another equally strong method.

1. Steel Pipe: ASTM A53/A53M, Grade A, standard weight (Schedule 40), black, NPS 1-1/2 (DN 40) nominal diameter unless otherwise indicated.
2. Finish: Shop painted black, with a 1 inch (25 mm) wide yellow stripe at center of each batten.

B. Supports, Clamps, and Anchors: ASTM A153/A153M, Class B, galvanized sheet steel in manufacturer's standard thicknesses, galvanized after fabrication.

C. Inserts, Bolts, Rivets, and Fasteners: Manufacturer's standard corrosion-resistant units.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for supporting members, blocking, installation tolerances, clearances, and other conditions affecting performance of stage-curtain work.

B. Examine inserts, clips, blocking, or other supports required to be installed by others to support tracks and battens.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install stage-curtain system according to curtain and track manufacturer's written instructions.

3.3 BATTEN INSTALLATION

A. Install battens by suspending at heights indicated with trim and supports spaced to support load, except do not exceed 10 feet (3 m) between supports.

3.4 TRACK INSTALLATION

A. Batten-Hung Track: Install track by suspending from pipe batten with manufacturer's track clamp hangers attached to batten pipe clamps at track-support spacing, according to manufacturer's written instructions.

B. Track-Support Spacing: According to manufacturer's recommendations for applied loads, but not exceeding the following dimensions between supports:

1. Curved Walk-Along Track: 48 inches (1219 mm), with additional supports at curves and splices.

3.5 CURTAIN INSTALLATION

A. Track Hung: Secure curtains to track carriers with S-hooks.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain stage curtains and tracks.

END OF SECTION 116143

This page intentionally left blank.

SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Manually operated roller shades with single rollers.

B. Related Requirements:

1. Section 054000 "Cold-Formed Metal Framing" for metal backing required for mounting roller shades and accessories and concealed within other construction before roller shades and accessories installation.
2. Section 092216 "Non-Structural Metal Framing" for metal backing required for mounting roller shades and accessories and concealed within other construction before roller shades and accessories installation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations. Provide floor plan and elevation for each window.

1. Manually Operated Shades: Show location of chain-and-clutch operating mechanisms.

C. Samples for Verification: For each type of roller shade.

1. Shadeband Material: Not less than 10 inches (250 mm) square. Mark interior face of material if applicable.
2. Roller Shade: Full-size operating unit, not less than 16 inches (400 mm) wide by 36 inches (900 mm) long for each type of roller shade indicated.
3. Installation Accessories: Full-size unit, not less than 10 inches (250 mm) long.

D. Product Schedule: For roller shades. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of shadeband material.

C. Product Test Reports: For each type of shadeband material, tested for compliance with NFPA 701, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 ACCESSIBILITY REQUIREMENTS

A. Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

B. Reach Ranges:

1. General: Reach ranges shall comply with CBC Section 11B-308 per CBC Section 11B-308.1.

C. Operable Parts:

1. General: Operable parts shall comply with CBC Section 11B-309 per CBC Section 11B-309.1.
2. Operation: Operable parts shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate operable parts shall be 5 pounds (22.2 N) maximum per CBC Section 11B-309.4.

2.3 REGULATORY REQUIREMENTS

A. Shadeband material shall comply with California Code of Regulations, Title 19, Division 1, Chapter 8 - "Regulations Relating to Flame-Retardant Chemicals, Fabrics and Application."

2.4 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Draper Inc.
2. MechoShade Systems, Inc.
3. Skyco Shading Systems, Inc.

B. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Stainless steel.

a. Loop Length: As required to comply with requirements in the CBC and the 2010 ADA Standards for Accessible Design.

1) Manual chains shall be located within 48 inches (1219 mm) of finish floor.

b. Limit Stops: Provide upper and lower ball stops.
c. Chain-Retainer Type: Chain tensioner, jamb mounted.
d. Plastic hardware is not acceptable.

2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller shade weight and for lifting heavy roller shades.

a. Provide for shadebands that weigh more than 10 lb (4.5 kg) or for shades as recommended by manufacturer, whichever criterion is more stringent.
b. Comply with applicable requirements in the CBC and the 2010 ADA Standards for Accessible Design.
c. Plastic hardware is not acceptable.

C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: Right side of interior face of shade unless otherwise indicated.
2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller unless otherwise indicated.
3. Shadeband-to-Roller Attachment: Removable spline fitting into integral channel in tube.
4. Plastic hardware is not acceptable.

D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

1. Provide galvanized or zinc-plated steel brackets.
2. Plastic hardware is not acceptable.

E. Shadebands:

1. Shadeband Material: Light-blocking fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

a. Type: Enclosed in sealed pocket of shadeband material.
b. Plastic hardware is not acceptable.

F. Installation Accessories:

1. Recessed Shade Pocket: Rectangular, extruded-aluminum enclosure designed for recessed ceiling installation; with front, top, and back formed as one piece, end plates, and removable bottom closure panel.

a. Height: Manufacturer's standard height required to enclose roller and shadeband assembly when shade is fully open, but not less than 4 inches (102 mm).
b. Provide pocket with lip at lower edge to support acoustical ceiling panel.

2. Installation Accessories Color and Finish: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

2.5 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Blocking Fabric: Opaque fabric, stain and fade resistant.

1. Source: Roller shade manufacturer.
2. Type: Acrylic-coated fiberglass.
3. Weave: Mesh.
4. Roll Width: Not less than 72 inches (1829 mm).
5. Orientation on Shadeband: Up the bolt.
6. Openness Factor: 0 percent.
7. Color: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

2.6 ROLLER SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):

1. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:

1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, locations of connections to building electrical system, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

1. Opaque Shadebands: Located so shadeband is not less than 2 inches (51 mm) from interior face of glass. Allow clearances for window operation hardware.

B. Roller Shade Locations: Provide roller window shades at all exterior windows except in the lobby.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 122413

SECTION 123623.13 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes plastic-laminate-clad countertops.

B. Related Requirements:

1. Section 064116 "Plastic-Laminate-Faced Architectural Cabinets."

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 COORDINATION

A. Coordinate sizes and locations of corner blocks and other supports specified in other Sections to ensure that countertops can be supported and installed as indicated.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For plastic-laminate-clad countertops.

1. Include plans, sections, details, and attachments to other work. Detail fabrication and installation, including field joints.
2. Show locations and sizes of cutouts and holes for items installed in plastic-laminate-clad countertops.
3. Apply WI Certified Compliance Program label to Shop Drawings.

C. Samples for Verification: As follows:

1. Plastic Laminates: For each type, color, pattern, and surface finish required, 12 by 12 inches (300 by 300 mm) in size.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator.

B. Product Certificates: For the following:

1. Composite wood products.
2. High-pressure decorative laminate.
3. Adhesives.

C. Quality Standard Compliance Certificates: WI Certified Compliance Program.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1. Shop Certification: WI's Certified Compliance Program licensee.

B. Installer Qualifications: Fabricator of products. WI's Certified Compliance Program licensee.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver countertops only after casework and supports on which they will be installed have been completed in installation areas.

B. Store countertops in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

C. Keep surfaces of countertops covered with protective covering during handling and installation.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where countertops are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 ACCESSIBILITY REQUIREMENTS

A. Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

2.2 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Regional Materials: Plastic-laminate countertops shall be manufactured within 500 miles (800 km) of Project site.

C. Recycled Content of Particleboard: Recycled content not less than 20 percent.

D. Recycled Content of Medium-Density Fiberboard: Recycled content not less than 20 percent.

E. Particleboard:

1. Composite Wood Products: Hardwood plywood, particleboard and medium density fiberboard composite wood products used on the interior or exterior of the building shall meet the requirements for formaldehyde as specified in California Air Resources Board's (CARB) Air Toxics Control Measure (ATCM) for Composite Wood (17 CCR 93120 et seq.) per CGBC Section 5.504.4.5. Those materials not exempted under ATCM must meet the specified emission limits, as shown in CGBC Table 5.504.4.5.
2. Composite Wood Products: Products shall be made without urea formaldehyde.
3. Formaldehyde emissions shall not exceed 0.09 ppm per CGBC Table 5.504.4.5.

F. Medium-Density Fiberboard:

1. Composite Wood Products: Hardwood plywood, particleboard and medium density fiberboard composite wood products used on the interior or exterior of the building shall meet the requirements for formaldehyde as specified in California Air Resources Board's (CARB) Air Toxics Control Measure (ATCM) for Composite Wood (17 CCR 93120 et seq.) per CGBC Section 5.504.4.5. Those materials not exempted under ATCM must meet the specified emission limits, as shown in CGBC Table 5.504.4.5.
2. Composite Wood Products: Products shall be made without urea formaldehyde.
3. Formaldehyde emissions shall not exceed 0.11 ppm per CGBC Table 5.504.4.5.

G. Finish Material Pollutant Control: Finish materials shall comply with CGBC Sections 5.504.4.1 through 5.504.4.6 per CGBC Section 5.504.4.

1. Adhesives, Sealants, and Caulks: Adhesives, sealants, and caulks used on the project shall meet the requirements of the following standards per CGBC Section 5.504.4.1:

a. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in CBC Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with Rule 1168 prohibition on the use of certain

toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products specified in subparagraph below.

b. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

2. Adhesives shall comply with maximum VOC limits listed in CGBC Table 5.504.4.1.
3. Sealants and sealant primers shall comply with maximum VOC limits listed in CGBC Table 5.504.4.2.

H. VOC Content: Adhesives shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Multipurpose Construction Adhesives: 70 g/L.
2. Structural Wood Member Adhesives: 140 g/L.
3. Wood Glues: 30 g/L.

I. VOC Content: Sealants and sealant primers shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Architectural Sealants: 250 g/L.
2. Architectural Sealant Primers for Nonporous Substrates: 250 g/L.
3. Architectural Sealant Primers for Porous Substrates: 775 g/L.

J. Adhesives: Do not use adhesives that contain urea formaldehyde.

K. Low-Emitting Adhesives: Adhesives shall comply with the requirements of authorities having jurisdiction.

L. Low-Emitting Sealants: Sealants and sealant primers shall comply with the requirements of authorities having jurisdiction.

2.3 PLASTIC-LAMINATE-CLAD COUNTERTOPS

A. Quality Standard: Unless otherwise indicated, comply with the "North American Architectural Woodwork Standards 3.1" for grades of plastic-laminate-clad countertops indicated for construction, finishes, installation, and other requirements.

1. Provide inspections of fabrication and installation together with labels and certificates from WI certification program indicating that countertops comply with requirements of grades specified.
2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

B. North American Architectural Woodwork Standards 3.1 Grade: Custom.

C. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Abet Laminati Inc.
b. Formica Corporation.
c. Lamin-Art, Inc.
d. Nevamar; a Panolam Industries International, Inc. brand.
e. Pionite; a Panolam Industries International, Inc. brand.
f. Wilsonart LLC.

D. Laminate Cladding for Exposed Surfaces:

1. Flat Countertops: Grade HGS.
2. Postformed Countertops: Grade HGP.
3. Vertical Surfaces: Grade HGS.
4. Edges: Grade HGS.
5. Pattern Direction: Parallel to cabinet fronts unless indicated otherwise.

E. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

F. Edge Treatment: Same as laminate cladding on horizontal surfaces.

G. Core Material: Particleboard made with exterior glue. MDF made with exterior glue, or exterior-grade plywood.

H. Core Material at Sinks: Particleboard made with exterior glue, MDF made with exterior glue, or exterior-grade plywood.

I. Core Thickness: 3/4 inch (19 mm).

1. Build up countertop thickness to 1-1/2 inches (38 mm) at front, back, and ends with additional layers of core material laminated to top.

J. Backer Sheet: Provide plastic-laminate backer sheet, NEMA LD 3, Grade BKL, on underside of countertop substrate.

2.4 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.

1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of countertop and quality grade specified unless otherwise indicated.

1. MDF: Medium-density fiberboard, ANSI A208.2, Grade 130, Grade 130, made with binder containing no urea formaldehyde.
2. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde or Grade M-2-Exterior Glue.
3. Softwood Plywood: DOC PS 1.

2.5 ACCESSORIES

A. Wire-Management Grommets: Circular, molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Doug Mockett & Company, Inc.; ZG Flip-Top Series, or a comparable product by another manufacturer.
2. Outside Diameter: 4 inches (101.6 mm).
3. Color: Black unless otherwise indicated.

2.6 MISCELLANEOUS MATERIALS

A. Adhesive for Bonding Plastic Laminate: As selected by fabricator to comply with requirements.

B. Installation Adhesive: As selected by fabricator to comply with requirements.

C. Sealants: Comply with requirements in Section 079200 "Joint Sealants."

2.7 FABRICATION

A. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch (25 mm) over base cabinets. Ease edges to radius indicated for the following:

1. Solid-Wood (Lumber) Members: 1/16 inch (1.5 mm) unless otherwise indicated.

B. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times countertop fabrication will be complete.
2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended, and check measurements of assemblies against field measurements before disassembling for shipment.

C. Shop cut openings to maximum extent possible to receive appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately, and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of cutouts by saturating with varnish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.

B. Before installing countertops, examine shop-fabricated work for completion and complete work as required, including removal of packing.

3.2 INSTALLATION

A. North American Architectural Woodwork Standards 3.1 Grade: Install countertops to comply with same grade as item to be installed.

B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.

1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately, and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
2. Seal edges of cutouts by saturating with varnish.

C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.

1. Secure field joints in countertops with concealed clamping devices located within 6 inches (150 mm) of front and back edges and at intervals not exceeding 24 inches (600 mm). Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

D. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Countertop Installation: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Install countertops level and true in line. Use concealed shims as required to maintain not more than a 1/8 inch in 96 inches (3 mm in 2400 mm) variation from a straight, level plane.
2. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) o.c. and to walls with adhesive.
3. Seal joints between countertop and backsplash, if any, and joints where countertop and backsplash abut walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects. Where not possible to repair, replace countertops. Adjust joinery for uniform appearance.

B. Clean countertops on exposed and semiexposed surfaces.

C. Protection: Provide Kraft paper or other suitable covering over countertop surfaces, taped to underside of countertop at not less than 48 inches (1220 mm) o.c. Remove protection at Substantial Completion.

END OF SECTION 123623.13

This page intentionally left blank.

SECTION 123661.19 - QUARTZ AGGLOMERATE COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Quartz agglomerate countertops.
2. Quartz agglomerate backsplashes.
3. Quartz agglomerate end splashes.
4. Quartz agglomerate apron fronts.

B. Related Requirements:

1. Section 224216.13 "Commercial Lavatories" for lavatories and plumbing fittings.
2. Section 224216.16 "Commercial Sinks" for sinks and plumbing fittings.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 COORDINATION

A. Coordinate sizes and locations of corner blocks and other supports specified in other Sections to ensure that countertops can be supported and installed as indicated.

B. Coordinate locations of utilities that will penetrate countertops or backsplashes.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For quartz agglomerate countertops.

1. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
2. Show locations and details of joints.
3. Show direction of directional pattern, if any.
4. Apply WI Certified Compliance Program label to Shop Drawings.

C. Samples for Verification: As follows:

1. Quartz Agglomerate Countertop Material: For each type, color, pattern, and surface finish required, 12 by 12 inches (300 by 300 mm) in size.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties.

C. Quality Standard Compliance Certificates: WI Certified Compliance Program.

D. Warranty: Submit specimen copy of specified warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For quartz agglomerate countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1. Submit manufacturer's published maintenance and care manual.

1.8 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1. Shop Certification: WI's Certified Compliance Program licensee.

B. Installer Qualifications: Fabricator of products. WI's Certified Compliance Program licensee.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's recommendations for shipping and handling quartz surfacing materials to preclude breakage and damage. Brace quartz surfacing units as necessary during shipment, transporting in near-vertical position with finished face towards finished face. Do not allow finished surfaces to rub during shipping and handling.

B. Store materials protected from exposure to harmful weather conditions, at temperature and humidity conditions recommended by the manufacturer. Store quartz surfacing sheet materials on racks in near-vertical position to preclude damage. Store with finished face turned towards finished face. Prevent warpage and breakage.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete. Show recorded measurements on shop drawings.

C. Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where countertops are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

D. Adhesives: Acclimate adhesives to occupancy room temperatures with maximum temperature not to exceed 75 deg F (24 deg C).

1.11 WARRANTY

A. Manufacturer's Limited Warranty: Standard 10 Year Commercial and Residential Limited Warranty against defects in quartz surfacing sheet materials.

PART 2 - PRODUCTS

2.1 ACCESSIBILITY REQUIREMENTS

A. Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

2.2 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Regional Materials: Plastic-laminate countertops shall be manufactured within 500 miles (800 km) of Project site.

C. Finish Material Pollutant Control: Finish materials shall comply with CGBC Sections 5.504.4.1 through 5.504.4.6 per CGBC Section 5.504.4.

1. Adhesives, Sealants, and Caulks: Adhesives, sealants, and caulks used on the project shall meet the requirements of the following standards per CGBC Section 5.504.4.1:

a. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in CBC Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products specified in subparagraph below.

b. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of

more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

2. Adhesives shall comply with maximum VOC limits listed in CGBC Table 5.504.4.1.
3. Sealants and sealant primers shall comply with maximum VOC limits listed in CGBC Table 5.504.4.2.

D. VOC Content: Adhesives shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Multipurpose Construction Adhesives: 70 g/L.
2. Structural Wood Member Adhesives: 140 g/L.
3. Wood Glues: 30 g/L.

E. VOC Content: Sealants and sealant primers shall comply with the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Architectural Sealants: 250 g/L.
2. Architectural Sealant Primers for Nonporous Substrates: 250 g/L.
3. Architectural Sealant Primers for Porous Substrates: 775 g/L.

F. Adhesives: Do not use adhesives that contain urea formaldehyde.

G. Low-Emitting Adhesives: Adhesives shall comply with the requirements of authorities having jurisdiction.

H. Low-Emitting Sealants: Sealants and sealant primers shall comply with the requirements of authorities having jurisdiction.

2.3 QUARTZ AGGLOMERATE COUNTERTOP MATERIALS

A. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with ICPA SS-1, except for composition.

1. Basis-of-Design Product - Type 1: Subject to compliance with requirements, provide Caesarstone; Classico, or a comparable product by another manufacturer.

   a. Colors and Patterns: 4001 Fresh Concrete.

2. Basis-of-Design Product - Type 2: Subject to compliance with requirements, provide Pental Surfaces; PentalQuartz, Inspire Collection, or a comparable product by another manufacturer.

   a. Colors and Patterns: BS124P Coastal Grey.

3. Basis-of-Design Product - Type 3: Subject to compliance with requirements, provide Daltile; Natural Quartzite - Natural Stone Slab, or a comparable product by another manufacturer.

   a. Colors and Patterns: NQ29 Mango Grove.

2.4 COUNTERTOP FABRICATION

A. Fabricate countertops according to quartz agglomerate manufacturer's written instructions and the "North American Architectural Woodwork Standards 3.1."

1. Provide inspections of fabrication and installation together with labels and certificates from WI certification program indicating that countertops comply with requirements of grades specified.
2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

B. North American Architectural Woodwork Standards 3.1 Grade: Custom.

C. Configuration:

1. Front: Straight, slightly eased at top.
2. Backsplash: Straight, slightly eased at corner.
3. End Splash: Matching backsplash.
4. Apron: Straight, slightly eased at bottom.

D. Countertops: 3/4 inch (20 mm) thick, quartz agglomerate with front edge built up with same material.

E. Backsplashes: 3/4 inch (20 mm) thick, quartz agglomerate.

F. End Splashes: 3/4 inch (20 mm) thick, quartz agglomerate.

G. Aprons: 3/4 inch (20 mm) thick, quartz agglomerate.

H. Fabricate tops with shop-applied edges and aprons unless otherwise indicated. Comply with quartz agglomerate manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes and end splashes for field assembly.

I. Joints: Fabricate countertops without joints, unless unavoidable.

J. Joints: Fabricate countertops in sections for joining in field, with joints at locations indicated.

1. Joint Locations: Not within 18 inches (450 mm) of a sink or cooktop and not where a countertop section less than 36 inches (900 mm) long would result, unless unavoidable.
2. Joint Type: Bonded, 1/32 inch (0.8 mm) or less in width.
3. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints where required. Make width of cuts slightly more than thickness of splines to provide snug fit. Provide not less than three splines in each joint.

K. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch (5 mm) into fixture opening.

2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.5 INSTALLATION MATERIALS

A. Adhesive: Product recommended by quartz agglomerate manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive quartz agglomerate countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. North American Architectural Woodwork Standards 3.1 Grade: Install countertops to comply with same grade as item to be installed.

B. Install countertops level to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m), 1/4 inch (6 mm) maximum. Do not exceed 1/64 inch (0.4 mm) difference between planes of adjacent units.

C. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with quartz agglomerate manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

D. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

1. Install metal splines in kerfs in countertop edges at joints where required. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

E. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

F. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

H. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects. Where not possible to repair, replace countertops. Adjust joinery for uniform appearance.

B. Clean countertops on exposed and semiexposed surfaces.

C. Protection: Provide Kraft paper or other suitable covering over countertop surfaces, taped to underside of countertop at not less than 48 inches (1220 mm) o.c. Remove protection at Substantial Completion.

END OF SECTION 123661.19

This page intentionally left blank.

SECTION 124816 - ENTRANCE FLOOR GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes recessed floor grilles and frames.

1.3 COORDINATION

A. Coordinate size and location of recesses in concrete to receive floor grilles and frames.

B. Coordinate frame installation with concrete construction to ensure recess and frame anchorage are accurate and that the base is level and flat.

C. Defer frame installation until building enclosure is complete and related interior finish work is in progress.

D. Furnish templates for placement of floor grilles and frames embedded in permanent construction by other installers.

1. Stainless-steel grilles are not field adjustable. Include optional factory template service for each floor grille assembly.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for entrance floor grilles and frames.

B. Shop Drawings:

1. Items penetrating floor grilles and frames, including door control devices.
2. Divisions between grille sections.
3. Perimeter floor moldings.

C. Samples for Verification: For the following products, in manufacturer's standard sizes:

1. Floor Grille: Assembled section of floor grille.
2. Frame Members: Sample of each type and color.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For floor grilles and frames to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.7 FIELD CONDITIONS

A. Field Measurements:

1. Check actual openings for floor grilles and frames by accurate field measurements before fabrication.
2. Record actual measurements on final shop drawings.
3. Coordinate fabrication schedule with construction progress to avoid delay of work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide C/S Group; 1-1/8 inch deep, Stainless-Steel, G6P - GridLine 2, with Straight Rails, Level Base Drain Pan Frame, and Hidden Lock Downs, or a comparable product by one of the following:

1. Babcock-Davis.
2. Balco, Inc.
3. JL Industries, Inc.; a division of the Activar Construction Products Group.
4. K. N. Crowder Manufacturing, Inc.
5. Kadee Industries, Inc.
6. Mats Incorporated.
7. McGill Architectural Products.
8. Nystrom, Inc.
9. Pawling Corporation.
10. ProSpec; an Oldcastle company.
11. Reese Enterprises, Inc.

B. Source Limitations: Obtain floor grilles and frames from single source from single manufacturer.

2.2 ACCESSIBILITY REQUIREMENTS

A. Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

B. Floor or Ground Surfaces:

1. General: Floor and ground surfaces shall be stable, firm, and slip resistant and shall comply with CBC Section 11B-302 per CBC Section 11B-302.1.

a. Exceptions:

1) Within animal containment areas, floor and ground surfaces shall not be required to be stable, firm, and slip resistant.
2) Areas of sport activity shall not be required to comply with CBC Section 11B-302.

2. Openings: Openings in floor or ground surfaces shall not allow passage of a sphere more than 1/2 inch (12.7 mm) diameter except as allowed in CBC Sections 11B-407.4.3, 11B-409.4.3, 11B-410.4, 11B-810.5.3, and 11B-810.10. Elongated openings shall be placed so that the long dimension is perpendicular to the dominant direction of travel per CBC Section 11B-302.3 and CBC Figure 11B-302.3.

2.3 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. Static Coefficient of Friction (SCOF): Floor grilles and frames shall meet or exceed the following values as determined by testing with the James Machine per ASTM D 2047:

1. Dry Neolite: Not less than 0.55.
2. Wet Neolite: Not less than 0.70.

C. Structural Performance: Provide floor grilles and frames capable of withstanding the following loads and stresses:

1. Uniform floor load of not less than 300 lbf/sq. ft. (14.36 kN/sq. m).
2. Wheel load of 500 lb (227 kg) per wheel.

2.4 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Recycled Content of Stainless Steel Products: Recycled content not less than 20 percent.

C. Pollutant Control:

1. Hazardous Particulates and Chemical Pollutants: Minimize and control pollutant entry into buildings and cross-contamination of regularly occupied areas per CGBC Section A5.504.5.

a. Entryway Systems: Install permanent entryway systems measuring at least six feet in the primary direction of travel to capture dirt and particulates at entryways directly connected to the outdoors per CGBC Section A5.504.5.1.

1) Qualifying entryways are those that serve as regular entry points for building users.
2) Acceptable entryway systems include, but are not limited to, permanently installed grates, grilles, or slotted systems that allow cleaning underneath.
3) Roll-out mats are acceptable only when maintained regularly by janitorial contractors as documented in service contract or by in-house staff as documented by written policies and procedures.

2.5 FLOOR GRILLES

A. General: Provide manufacturer's standard floor-grille assemblies consisting of treads of type and profile indicated, interlocked or joined together by cross members, and with support legs (if any) and other components needed to produce a complete installation.

B. Stainless-Steel Floor Grille:

1. Depth: 1-1/8 inch (28.575 mm).
2. Surface Treads: 0.140 by 0.125 inch (3.556 by 3.175 mm) wire with 0.187 inch (4.7498 mm) wide openings between wires.
3. Support Structure: U-clips.
4. Grille Size:

   a. Single Door: Provide floor grille full width of door plus 18 inches (457.2 mm) on strike side of door by 72 inches (1828.8 mm) in the primary direction of travel or as indicated on Drawings whichever is larger.
   b. Double Door: Provide floor grille full width of door by 72 inches (1828.8 mm) in the primary direction of travel or as indicated on Drawings whichever is larger.

C. Lockdown: Hidden Lock Down (HL).

1. 1/8 inch (3.175 mm) by 1-1/4 inch (31.75 mm) by 1-1/4 inch (31.75 mm) stainless-steel hold-down plate to secure grille to concrete substrate, one at each corner starting on inside of outer most support, spaced 36 inches (914.4 mm) to 48 inches (1219.2 mm) o.c., slots shall run parallel to supports, all slots facing same direction.

2.6 FRAMES

A. Provide manufacturer's standard frames of size and style for grille type, for permanent recessed installation in subfloor, complete with installation anchorages and accessories. Unless otherwise indicated, fabricate frame of same material and finish as grilles.

B. Level Base Frame:

1. 1-1/8 inches (28.575 mm) deep recess, 1-1/4 inches (31.75 mm) deep overall, 1/8 inch (3.175 mm) thick, 1/8 inch (3.175 mm) exposed surface, stainless-steel frame.

2.7 DRAIN PANS

A. Provide manufacturer's standard, 0.0500 inch (1.27 mm) thick (18 gage nominal), stainless-steel sheet drain pan with general purpose PVC NPS 2 (DN 50) drain outlet, with stainless-steel strainer, for each floor-grille unit. Coat bottom of pan with protective coating recommended by manufacturer.

2.8 MATERIALS

A. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.

B. Stainless-Steel Angles: ASTM A 276 or ASTM A 479/A 479M, Type 304.

2.9 MISCELLANEOUS MATERIALS

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for exterior applications.

2.10 FABRICATION

A. Shop fabricate floor grilles to greatest extent possible in sizes as indicated. Unless otherwise indicated, provide each grille as a single unit; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in grilles are necessary, space symmetrically and away from normal traffic lanes.

B. Fabricate frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.

2.11 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run grain of directional finishes with long dimension of each piece.
2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
3. Directional Satin Finish: No. 4.

C. Mill finish for surfaces not exposed to view.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and floor conditions for compliance with requirements for location, size, minimum recess depth, and other conditions affecting installation of floor grilles and frames.

B. Examine roughing-in for drainage piping systems to verify actual locations of piping connections before floor grille and frame and drain pan installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Manufacturer shall offer assistance and guidance and provide a template for each floor grille and frame assembly to ensure a proper installation.

3.3 INSTALLATION

A. Install recessed floor grilles, frames, and drain pans to comply with manufacturer's written instructions at locations indicated and with top of floor grilles and frames in relationship to one another and to adjoining finished flooring as recommended by manufacturer.

B. Set floor-grille tops at height recommended by manufacturer for most effective cleaning action.

C. Coordinate top of floor-grille surfaces with doors that swing across grilles to provide clearance under door.

3.4 CLEANING

A. Clean exposed surface of floor grilles and frames and recessed well not more than four days before date scheduled for inspections that establish date of Substantial Completion.

B. Clean floor grilles and frames as recommended in writing by manufacturer.

3.5 PROTECTION

A. After completing frame installations, provide temporary filler of plywood or fiberboard in floor-grille recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

B. Defer final installation of floor grilles until time of substantial completion of project.

END OF SECTION 124816

SECTION 142400 - HYDRAULIC ELEVATORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes hydraulic passenger elevators.

1. Elevator work includes, but is not limited to, the following:

a. Standard pre-engineered hydraulic passenger elevators.
b. Elevator car enclosures, hoistway entrances, and signal equipment.
c. Operation and control systems.
d. Jack(s).
e. Accessibility provisions for physically disabled persons.
f. Equipment, machines, controls, systems, and devices as required for safely operating elevators at their rated speed and capacity.
g. Materials and accessories as required to complete the elevator installation.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for temporary use of elevators for construction purposes.
2. Section 033000 "Cast-in-Place Concrete" for setting sleeves, inserts, and anchoring devices in concrete.
3. Section 042000 "Unit Masonry" for setting sleeves, inserts, and anchoring devices in masonry and for grouting elevator entrance frames installed in masonry walls.
4. Section 051200 "Structural Steel Framing" for the following:

a. Attachment plates, angle brackets, and other structural-steel preparations for fastening guide-rail brackets.
b. Hoist beams.
c. Structural-steel shapes for subsills that are part of steel frame.

5. Section 055000 "Metal Fabrications" for the following:

a. Structural-steel shapes for subsills that are not part of steel frame.
b. Pit ladders.
c. Cants made from steel sheet in hoistways.

6. Section 093013 "Ceramic Tiling" for finish flooring in elevator cars.
7. Section 099123 "Interior Painting" for field painting of unfinished and shop primed ferrous materials.
8. Division 22 Sections for sump pumps, sumps, sump covers, and oil interceptor in elevator pits.
9. Division 23 Sections for heating, ventilating, and air conditioning in hoistways and machine rooms.

10. Division 26 Sections for the following:

    a. Providing electrical service to elevators, including fused disconnect switches.
    b. Emergency power supply, transfer switch and auxiliary contacts.
    c. Convenience outlets and illumination in control room, hoistway and pit.

11. Division 27 Sections for twisted pair conductors used for telephone service for elevators and for Internet connection to elevator controllers for remote monitoring of elevator performance if required.
12. Division 28 Sections for smoke detectors in elevator lobbies to initiate emergency recall operation and heat detectors in shafts and machine rooms to disconnect power from elevator equipment before sprinkler activation and for connection to elevator controllers.

C. Work Specified in Other Sections: The following shall be provided in accordance with the requirements of the California Building Code and ASME A17.1/CSA B44. For specific requirements, refer to ASME A17.1/CSA B44, Part 3 for hydraulic elevators. Comply with State and local requirements if more stringent.

1. Elevator hoist beam shall be provided at top of elevator hoistway. Beam shall be able to accommodate loads and clearances required for elevator installation and operation. Coordinate requirements with elevator installer.
2. Elevator installer shall furnish, in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports, and bracing. Elevator installer shall furnish setting templates and diagrams for placement.
3. Elevator hoistway walls shall have not less than two hour fire rating.
4. Elevator hoistway shall be clear and plumb without variations exceeding 1/2 inch (12.7 mm) at any point.
5. Elevator hoistways shall have barricades, where indicated and where required.
6. Provide bevel guards at 75 degrees on all recesses, projections, and setbacks over 2 inches (50.8 mm) (4 inches (101.6 mm) for ASME A17.1/CSA B44-2000 areas) except for loading or unloading.
7. Provide guide rail bracket supports at pit, each floor, and roof.

    a. For guide rail bracket supports, provide divider beams between hoistway at each floor and roof, where indicated and where required.

8. Pit floor shall be level and free of debris. Reinforce dry pit to sustain vertical forces from rails and buffers. Coordinate requirements with elevator installer.
9. Where pit access is by means of the lowest hoistway entrance, a vertical ladder of non-combustible material extending not less than 42 inches (1066.8 mm), (not less than 48 inches (1219.2 mm) for ASME A17.1/CSA B44-2000 areas) shall be provided at the same height, above sill of access door or handgrips.
10. Machine room shall be enclosed and protected.
11. Machine Room temperature shall be maintained between 55 deg F (12.8 deg C) and 90 deg F (32.2 deg C).
12. Where machine room is remote from the elevator hoistway, clear access above the ceiling shall be provided or metal/concrete raceways in floor shall be provided for oil line and wiring duct from machine room to elevator hoistway.
13. Access to the machinery space and machine room shall be in accordance with requirements of authorities having jurisdiction and code.
14. Provide an 8 by 16 inch (203.2 by 406.4 mm) cutout through machine room wall, for oil line and wiring duct. Coordinated size and location with elevator installer.
15. All wire and conduit shall run remote from the hoistways and the machine room.

16. Where heat, smoke, or combustion sensing devices are required, connect heat, smoke, and combustion sensing devices to elevator control cabinet terminals. Contacts on the sensing devices should be sided for 12 volt D.C.
17. Provide finish flooring in elevator cab.
18. Finish flooring and entrance walls shall not be installed before sills and door frames are installed. Coordinate rough opening size with elevator installer.

    a. Provide metal framing and gypsum board construction that maintains the fire resistance rating of wall where metal framing and gypsum board construction is used.

19. Where metal framing and gypsum board construction is used for front walls, it shall be of sufficient strength to maintain the doors in true lateral alignment. Coordinate requirements with elevator installer.
20. Before erection of rough walls and doors; erect hoistway sills, headers, and frames. After rough walls are finished; erect fascias and toe guards. Set sill level and slightly above finished floor at landings.
21. To maintain legal fire rating where masonry construction is used for walls, door frames shall be anchored to walls and grouted in place.
22. The elevator wall shall interface with the hoistway entrance assembly and be in compliance with the elevator installer's requirements.
23. Fill and grout around entrances, as required.
24. Provide elevator sill supports at each opening.
25. Walls and sill supports shall be plumb at each opening.
26. For applications where jack hole is required:

    a. Provide free and clear access to the elevator pit area for the jack hole-drilling rig.
    b. Remove all spoils from jack hole drilling.
    c. Jack hole shall accommodate the jack unit.
    d. Provide jack hole in accordance with the elevator shop drawings.

27. Provide a light fixture, 19 fc (200 lx), with switch and convenience outlet in pit. Locate switch adjacent to the access door.
28. Provide a light switch and fused disconnect switch for each elevator. Locate in machine room adjacent to door, where practical, per the CEC and NFPA 70).
29. Signal Systems and Power Operated Door: Provide ground and branch wiring circuits, including main line switch.
30. Car Light and Fan: Provide feeder and branch wiring circuits, including main line switch.
31. Increase wall thickness where required to accommodate fixtures mounted in metal framing and gypsum board construction. Coordinate requirements with elevator installer.
32. Provide supports, patching, and recesses to accommodate hall button boxes, signal fixtures, and other components mounted in walls. Coordinate requirements with elevator installer.
33. Provide telephone and convenience outlet on control panel. Coordinate locations with elevator installer.

1.03 DEFINITIONS

A. Definitions in ASME A17.1/CSA B44 apply to work of this Section.

B. Service Elevator: A passenger elevator that is also used to carry freight.

1.04 ACTION SUBMITTALS

A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for car enclosures; hoistway entrances; and operation, control, and signal systems.

B. Shop Drawings:

1. Include plans, elevations, sections, and large-scale details indicating service at each landing; machine room layout; coordination with building structure; relationships with other construction; and locations of equipment.

a. Include equipment arrangement in the machine room/control space, pit and hoistway.
b. Include details of assembly, erection, anchorage, and equipment location.

2. Include elevator system capacities, sizes, performances, safety features, finishes, and other pertinent information.
3. Indicate floors served, travel distances, maximum loads imposed on the building structure at points of support, and similar considerations of the elevator work.
4. Indicate electrical power requirements and branch circuit protection device recommendations.
5. Include large-scale layout of car-control station and battery-power operation control panel.
6. Indicate maximum dynamic and static loads imposed on building structure at points of support as well as maximum and average power demands.

C. Samples for Verification: For exposed car, hoistway door and frame, and signal equipment finishes, 3 inch (75 mm) square Samples of sheet materials and 4 inch (100 mm) lengths of running trim members.

D. Delegated-Design Submittal: For hydraulic passenger elevators indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Prepare submittal items for hydraulic passenger elevator installation, including attachment to the building structure, for submittal to and approval by DSA.

a. Include detailed calculations and drawings for hydraulic passenger elevator, including guide rail bracket and power unit attachment to the building structure, prepared, stamped, and signed by a Structural Engineer licensed in the State of California.

2. Delegated-design submittal shall be reviewed and approved by DSA prior to fabrication, installation, or use and prior to commencement of the work shown thereon.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Seismic Qualification Certificates: For elevator equipment, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Manufacturer Certificates: Signed by elevator manufacturer, certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.

D. Sample Warranty: For special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.

1. Submit manufacturer's/installer's standard operation and maintenance manual, in accordance with ASME A17.1/CSA B44.
2. Owner's manuals and wiring diagrams.
3. Parts list, with recommended parts inventory.

B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

C. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in the form of a standard one-year, two-year, or five-year maintenance agreement, as requested by Owner, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 15 years experience manufacturing, installing, and servicing elevators of the type required for the project.

1. Manufacturer shall provide machines, power unit, controllers, signal fixtures, door operators, cabs, entrances, and other major parts of elevator operating equipment.

a. The major parts of the elevator operating equipment shall be manufactured by the installing company, and shall not be an assembled system.

2. Manufacturer shall have a documented, on-going quality assurance program.
3. Manufacturer shall be ISO-9001:2000 Manufacturer Certified.
4. Manufacturer shall be ISO-14001:2004 Environmental Management System Certified.

B. Installer Qualifications: Elevator manufacturer or an authorized representative who is trained and approved by manufacturer with not less than 15 years experience installing and servicing elevators of the type required for the project.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials, components and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.09 PROJECT CONDITIONS

A. Temporary Use: Elevators shall not be used for temporary service or for any other purpose prior to Substantial Completion and acceptance by the Owner without signed agreement between Owner, Installer, and Contractor.

1. Elevators used prior to Substantial Completion shall be cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition before initial use, including replacing worn cables, guide shoes, and similar items of limited life.

a. Do not load elevators beyond their rated weight capacity.
b. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.

B. Provide the hole for the jack unit, if required by the type of jack provided, based on excavation through normal soil or clay which can be removed by manual digging or by standard truck-mounted regular drilling unit. Provide a casing, if required, to retain the walls of the hole. Remove excavation spoils.

1. If a physical obstruction or hindrance is encountered below the ground surface, including boulders, rock, gravel, wood, metal, pilings, sand, water, quick sand, caves, public utilities or any other foreign material, excavator shall obtain written authorization to proceed with excavating using special excavation equipment.
2. Excavator shall maintain a daily log of time and material costs involved.
3. Excavator shall be compensated on a time and material basis for additional costs incurred after encountering the physical obstruction or hindrance, including the cost of the special excavation equipment.

1.10 COORDINATION

A. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.

B. Coordinate locations and dimensions of other work specified in other Sections that relates to hydraulic elevators, including pit ladders; sumps and floor drains in pits; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways, pits, and machine rooms.

C. Coordinate elevator work with the work of other trades, for proper time and sequence to avoid construction delays. Use benchmarks, lines, and levels designated by the Contractor, to ensure dimensional coordination of the work.

1.11 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of

materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

2. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide ThyssenKrupp Elevator; Endura, Twinpost, Above-Ground, Telescopic, 2-Stage, Model AMEE 35 HLS, or a comparable product by one of the following:

1. American Crescent Elevator Mfg., Corp.
2. Fujitec America, Inc.
3. KONE Inc.
4. Minnesota Elevator, Inc.
5. Mowrey Elevator Co.
6. Otis Elevator Co.
7. Schindler Elevator Corp.
8. Schumacher Elevator Co.

B. Source Limitations: Obtain elevators from single manufacturer.

1. Major elevator components, including pump-and-tank units, plunger-cylinder assemblies, controllers, signal fixtures, door operators, car frames, cars, and entrances, shall be manufactured by single manufacturer.

2.02 ACCESSIBILITY REQUIREMENTS

A. Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

B. Elevators shall comply with applicable provisions in California Code of Regulations, Title 8.

C. Elevators shall comply with applicable provisions in CBC Chapter 30.

1. Accessibility: Passenger elevators and platform (wheelchair) lifts required to be accessible or to serve as part of an accessible means of egress shall comply with CBC Section 1009 and either CBC Chapter 11A for applications listed in Section 1.8.2.1.2 regulated by the Department of Housing and Community Development or Chapter 11B for applications listed in Section 1.9.1 regulated by the Division of the State Architect – Access Compliance per CBC Section 3001.3

D. Two-Way Communication: A two-way communication system complying with CBC Sections 1009.8.1 and 1009.8.2 shall be provided at the landing serving each elevator or bank of elevators on each accessible floor that is one or more stories above or below the level of exit discharge per CBC Section 1009.8.

1. Exceptions:

a. Two-way communication systems are not required at the landing serving each elevator or bank of elevators where the two-way communication system is provided within areas of refuge in accordance with CBC 1009.6.5.
b. Two-way communication systems are not required on floors provided with ramps conforming to the provisions of CBC Section 1012.
c. Two-way communication systems are not required at the landings serving only service elevators that are not designated as part of the accessible means of egress or serve as part of the required accessible route into a facility.
d. Two-way communication systems are not required at the landings serving only freight elevators.
e. Two-way communication systems are not required at the landing serving a private residence elevator.

2. System Requirements: Two-way communication systems shall provide communication between each required location and a central control point location approved by the fire department. Where the central control point is not a constantly attended location, the two-way communication system shall have a timed automatic telephone dial-out capability to a monitoring location. The two-way communication system shall include both audible and visible signals per CBC Section 1009.8.1.

a. Visible Communication Method: A button complying with CBC Section 1138A.4 or CBC Sections 11B-205 and 11B-309 in the area of refuge shall activate both a light in the area of refuge indicating that rescue has been requested and a light at the central control point indicating that rescue is being requested. A button at the central control point shall activate both a light at the central control point and a light in the area of refuge indicating that the request has been received per CBC Section 1009.8.1.1.

3. Directions: Directions for the use of the two-way communication system, instructions for summoning assistance via the two-way communication system and written identification of the location shall be posted adjacent to the two-way communication system. Signage shall comply with CBC Section 1143A or CBC Section 11B-703.5 requirements for visual characters per CBC Section 1009.8.2.

E. Directional Signage: Direction signage complying with CBC Section 11B-703.5 indicating the location of other means of egress and which of those are accessible means of egress shall be provided at the following per CBC Section 1009.10.

1. At exits serving a required accessible space but not providing an approved accessible means of egress.
2. At elevator landings.
3. Within areas of refuge.

F. Elevators: Elevators provided for passengers shall comply with CBC Section 11B-407. Where multiple elevators are provided, each elevator shall comply with CBC Section 11B-407 per CBC Section 11B-206.6.

1. Exceptions:

a. In a building or facility permitted to use the exceptions to CBC Section 11B-206.2.3 or permitted by CBC Section 11B-206.7 to use a platform lift, elevators complying with CBC Section 11B-408 shall be permitted.
b. Elevators complying with CBC Section 11B-408 or 11B-409 shall be permitted in multi-story residential dwelling units. Elevators provided as a means of access within a private residence shall be installed so that they are not accessible to the general public or to other occupants of the building.
c. Destination-oriented elevators complying with CBC Section 11B-411 shall be permitted.

G. General: Elevators shall comply with CBC Section 11B-407 and with ASME A17.1. They shall be passenger elevators as classified by ASME A17.1. Elevator operation shall be automatic per CBC Section 11B-407.1.

1. Combined Passenger and Freight Elevators: When the only elevators provided for use by the public and employees are combination passenger and freight elevators, they shall comply with CBC Section 11B-407 and with ASME A17.1 per CBC Section 11B-407.1.1.

H. Elevator Landing Requirements: Elevator landings shall comply with CBC Section 11B-407.2 per CBC Section 11B-407.2.

1. Call Controls: Where elevator call buttons or keypads are provided, they shall comply with CBC Sections 11B-407.2.1 and 11B-309.4 per CBC Section 11B-407.2.1.

a. Operation: Operable parts shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate operable parts shall be 5 pounds (22.2 N) maximum per CBC Section 11B-309.4.
b. Height: Call buttons and keypads shall be located within one of the reach ranges specified in CBC Section 11B-308, measured to the centerline of the highest operable part per CBC Section 11B-407.2.1.1.
c. Size and Shape: Call buttons shall have square shoulders, be 3/4 inch (19.1 mm) minimum in the smallest dimension and shall be raised 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm) above the surrounding surface. The buttons shall be activated by a mechanical motion that is detectable per CBC Section 11B-407.2.1.2.
d. Clear Floor or Ground Space: A clear floor or ground space complying with CBC Section 11B-305 shall be provided at call controls per CBC Section 11B-407.2.1.3.
e. Location: The call button that designates the up direction shall be located above the call button that designates the down direction per CBC Section 11B-407.2.1.4.
f. Signals: Call buttons shall have visible signals that will activate when each call is registered and will extinguish when each call is answered. Call buttons shall be internally illuminated with a white light over the entire surface of the button per CBC Section 11B-407.2.1.5.
g. Keypads: Where keypads are provided, keypads shall be in a standard telephone keypad arrangement and shall comply with CBC Section 11B-407.4.7.2 per CBC Section 11B-407.2.1.6.

2. Hall Signals: Hall signals, including in-car signals, shall comply with CBC Section 11B-407.2.2 per CBC Section 11B-407.2.2.

a. Visible and Audible Signals: A visible and audible signal shall be provided at each hoistway entrance to indicate which car is answering a call and the car's direction of travel. Where in-car signals are provided, they shall be visible from the floor area adjacent to the hall call buttons per CBC Section 11B-407.2.2.1.
b. Visible Signals: Visible signal fixtures shall be centered at 72 inches (1829 mm) minimum above the finish floor or ground. The visible signal elements shall be a minimum 2-1/2 inches (64 mm) high by 2-1/2 inches (64 mm) wide. Signals shall be visible from the floor area adjacent to the hall call button per CBC Section 11B-407.2.2.2 and CBC Figure 11B-407.2.2.2.
c. Audible Signals: Audible signals shall sound once for the up direction and twice for the down direction, or shall have verbal annunciators that indicate the direction of elevator car travel. Audible signals shall have a frequency of 1500 Hz maximum. Verbal annunciators shall have a frequency of 300 Hz minimum and 3000 Hz maximum. The audible signal and verbal annunciator shall be 10 dB minimum above ambient, but shall not exceed 80 dB, measured at the hall call button per CBC Section 11B-407.2.2.3.

3. Hoistway Signs: Signs at elevator hoistways shall comply with CBC Section 11B-407.2.3 per CBC Section 11B-407.2.3.

    a. Floor Designation: Floor designations complying with CBC Sections 11B-703.2 and 11B-703.4.1 shall be provided on both jambs of elevator hoistway entrances. Floor designations shall be provided in both raised characters and Braille. Raised characters shall be 2 inches (51 mm) high. A raised star, placed to the left of the floor designation, shall be provided on both jambs at the main entry level. The outside diameter of the star shall be 2 inches (51 mm) and all points shall be of equal length. Raised characters, including the star, shall be white on a black background. Braille complying with CBC Section 11B-703.3 shall be placed below the corresponding raised characters and the star. The Braille translation for the star shall be "MAIN". Applied plates are acceptable if they are permanently fixed to the jamb per CBC Section 11B-407.2.3.1 and CBC Figure 11B-407.2.3.1.

I. Elevator Door Requirements: Hoistway and car doors shall comply with CBC Section 11B-407.3 per CBC Section 11B-407.3.

1. Type: Elevator doors shall be the horizontal sliding type. Car gates shall be prohibited per CBC Section 11B-407.3.1.
2. Operation: Elevator hoistway and car doors shall open and close automatically per CBC Section 11B-407.3.2.

    a. Exception: Existing manually operated hoistway swing doors shall be permitted provided that they comply with CBC Sections 11B-404.2.3 and 11B-404.2.9. Car door closing shall not be initiated until the hoistway door is closed.

3. Reopening Device: Elevator doors shall be provided with a reopening device complying with CBC Section 11B-407.3.3 that shall stop and reopen a car door and hoistway door automatically if the door becomes obstructed by an object or person per CBC Section 11B-407.3.3.

    a. Exception: Existing elevators with manually operated doors shall not be required to comply with CBC Section 11B-407.3.3.
    b. Height: The device shall be activated by sensing an obstruction passing through the opening at 5 inches (127 mm) nominal and 29 inches (737 mm) nominal above the finish floor per CBC Section 11B-407.3.3.1.
    c. Contact: The device shall not require physical contact to be activated, although contact is permitted to occur before the door reverses per CBC Section 11B-407.3.3.2.
    d. Duration: Door reopening devices shall remain effective for 20 seconds minimum per CBC Section 11B-407.3.3.3.

4. Door and Signal Timing: The minimum acceptable time from notification that a car is answering a call until the doors of that car start to close shall be calculated from the following equation per CBC Section 11B-407.3.4.

    a. T equals D/(1.5 ft/s) or T equals D/(455 mm/s) equals 5 seconds minimum.
    b. T: The total time in seconds.
    c. D: The distance (in feet or millimeters) from the point in the lobby or corridor 60 inches (1524 mm) directly in front of the farthest call button controlling that car to the centerline of its hoistway door.

        1) Exceptions:

a) For cars with in-car lanterns, T shall be permitted to begin when the signal is visible from the point 60 inches (1524 mm) directly in front of the farthest hall call button and the audible signal is sounded.

5. Door Delay: Elevator doors shall remain fully open in response to a car call for 5 seconds minimum per CBC Section 11B-407.3.5.
6. Width: The width of elevator doors shall comply with CBC Table 11B-407.4.1 per CBC Section 11B-407.3.6.

a. Exception: In existing elevators, a power-operated car door complying with CBC Section 11B-404.2.3 shall be permitted.

J. Elevator Car Requirements: Elevator cars shall comply with CBC Section 11B-407.4 per CBC Section 11B-407.4.

1. Car Dimensions: Inside dimensions of elevator cars and clear width of elevator doors shall comply with CBC Table 11B-407.4.1 per CBC Section 11B-407.4.1 and CBC Figure 11B-407.4.1.

a. Exception: In existing buildings, where existing shaft configuration prohibits strict compliance with CBC Section 11B-407.4.1, existing elevator car configurations that provide a clear floor area of 18 sq feet (1.67 sq m) minimum and also provide an inside clear depth 54 inches (1372 mm) minimum and a clear width 48 inches (1219 mm) minimum shall be permitted.

2. Floor Surfaces: Floor surfaces in elevator cars shall comply with CBC Sections 11B-302 and 11B-303 per CBC Section 11B-407.4.2.
3. Platform to Hoistway Clearance: The clearance between the car platform sill and the edge of any hoistway landing shall be 1-1/4 inch (32 mm) maximum per CBC Section 11B-407.4.3.
4. Leveling: Each car shall be equipped with a self-leveling feature that will automatically bring and maintain the car at floor landings within a tolerance of 1/2 inch (12.7 mm) under rated loading to zero loading conditions per CBC Section 11B-407.4.4.
5. Illumination: The level of illumination at the car controls, platform, car threshold, and car landing sill shall be 5 foot candles (54 lux) minimum per CBC Section 11B-407.4.5.
6. Elevator Car Controls: Where provided, elevator car controls shall comply with CBC Sections 11B-407.4.6 and 11B-309.4 per CBC Section 11B-407.4.6.

a. Exception: In existing elevators, where a new car operating panel complying with CBC Section 11B-407.4.6 is provided, existing car operating panels may remain operational and shall not be required to comply with CBC Section 11B-407.4.6.
b. Location: Controls shall be located within one of the reach ranges specified in CBC Section 11B-308 per CBC Section 11B-407.4.6.1.

1) Exceptions:

a) Where the elevator panel serves more than 16 openings and a parallel approach is provided, buttons with floor designations shall be permitted to be 54 inches (1372 mm) maximum above the finish floor.
b) In existing elevators, car control buttons with floor designations shall be permitted to be located 54 inches (1372 mm) maximum above the finish floor where a parallel approach is provided.

c. Buttons: Car control buttons with floor designations shall comply with CBC Section 11B-407.4.6.2 per CBC Section 11B-407.4.6.2.

1) Size and Shape: Buttons shall have square shoulders, be 3/4 inch (19.1 mm) minimum in their smallest dimension and be raised 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm) above the surrounding surface per CBC Section 11B-407.4.6.2.1.
2) Arrangement: Buttons shall be arranged with numbers in ascending order. When two or more columns of buttons are provided they shall read from left to right per CBC Section 11B-407.4.6.2.2.
3) Illumination: Car control buttons shall be illuminated per CBC Section 11B-407.4.6.2.3.
4) Operation: Car control buttons shall be activated by a mechanical motion that is detectable per CBC Section 11B-407.4.6.2.4.

d. Keypads: Car control keypads shall be in a standard telephone keypad arrangement and shall comply with CBC Section 11B-407.4.7.2 per CBC Section 11B-407.4.6.3.
e. Emergency Controls: Emergency controls shall comply with CBC Section 11B-407.4.6.4 per CBC Section 11B-407.4.6.4.

1) Height: Emergency control buttons shall have their centerlines 35 inches (889 mm) minimum above the finish floor per CBC Section 11B-407.4.6.4.1.
2) Location: Emergency controls, including the emergency alarm, shall be grouped at the bottom of the panel per CBC Section 11B-407.4.6.4.2.

7. Designations and Indicators of Car Controls: Designations and indicators of car controls shall comply with CBC Section 11B-407.4.7 per CBC Section 11B-407.4.7.

a. Exception: In existing elevators, where a new car operating panel complying with CBC Section 11B-407.4.7 is provided, existing car operating panels may remain operational and shall not be required to comply with CBC Section 11B-407.4.7.
b. Buttons: Car control buttons shall comply with CBC Section 11B-407.4.7.1 per CBC Section 11B-407.4.7.1.

1) Type: Control buttons shall be identified by raised characters or symbols, white on a black background, complying with CBC Section11B-703.2 and Braille complying with CBC Section 11B-703.3 per CBC Section 11B-407.4.7.1.1.
2) Location: Raised characters or symbols and Braille designations shall be placed immediately to the left of the control button to which the designations apply per CBC Section 11B-407.4.7.1.2.
3) Symbols: The control button for the emergency stop, alarm, door open, door close, main entry floor, and phone, shall be identified with raised symbols and Braille as shown in CBC Table 11B-407.4.7.1.3 per CBC Section 11B-407.4.7.1.3.
4) Visible Indicators: Buttons with floor designations shall be provided with visible indicators to show that a call has been registered. The visible indication shall extinguish when the car arrives at the designated floor per CBC Section 11B-407.4.7.1.4.
5) Button Spacing: A minimum clear space of 3/8 inch (9.5 mm) or other suitable means of separation shall be provided between rows of control buttons per CBC Section 11B-407.4.7.1.5.

c. Keypads: Keypads shall be identified by characters complying with CBC Section 11B-703.5 and shall be centered on the corresponding keypad button. The number five key shall have a single raised dot. The dot shall be 0.118 inch (3 mm) to 0.120 inch (3.05 mm) base diameter and in other aspects comply with CBC Table 11B-703.3.1 per CBC Section 11B-407.4.7.2.

8. Car Position Indicators: Audible and visible car position indicators shall be provided in elevator cars per CBC Section 11B-407.4.8.

a. Visible Indicators: Visible indicators shall comply with CBC Section 11B-407.4.8.1 per CBC Section 11B-407.4.8.1.

1) Size: Characters shall be 1/2 inch (12.7 mm) high minimum per CBC Section 11B-407.4.8.1.1.
2) Location: Indicators shall be located above the car control panel or above the door per CBC Section 11B-407.4.8.1.2.
3) Floor Arrival: As the car passes a floor and when a car stops at a floor served by the elevator, the corresponding character shall illuminate per CBC Section 11B-407.4.8.1.3.

b. Audible Indicators: Audible indicators shall comply with CBC Section 11B-407.4.8.2 per CBC Section 11B-407.4.8.2.

1) Signal Type: The signal shall be an automatic verbal annunciator which announces the floor at which the car is about to stop per CBC Section 11B-407.4.8.2.1.

a) Exception: For elevators that have a rated speed of 200 feet per minute (1 m/s) or less, a non-verbal audible signal with a frequency of 1500 Hz maximum which sounds as the car passes or is about to stop at a floor served by the elevator shall be permitted.

2) Signal Level: The verbal annunciator shall be 10 dB minimum above ambient, but shall not exceed 80 dB, measured at the annunciator per CBC Section 11B-407.4.8.2.2.
3) Frequency: The verbal annunciator shall have a frequency of 300 Hz minimum to 3000 Hz maximum per CBC Section 11B-407.4.8.2.3.

9. Emergency Communication: Emergency two-way communication systems shall comply with CBC Section 11B-308. Raised symbols or characters, white on a black background, and Braille shall be provided adjacent to the device and shall comply with CBC Sections 11B-703.2 and 11B-703.3. Emergency two-way communication systems between the elevator and a point outside the hoistway shall comply with ASME A17.1 per CBC Section 11B-407.4.9.
10. Support Rail: Support rails shall be provided on at least one wall of the car per CBC Section 11B-407.4.10.

a. Location: Clearance between support rails and adjacent surfaces shall be 1-1/2 inches (38 mm) minimum. Top of support rails shall be 31 inches (787 mm) minimum to 33 inches (838 mm) maximum above the floor of the car. The ends of the support rail shall be 6 inches (152 mm) maximum from adjacent walls per CBC Section 11B-407.4.10.1.
b. Surfaces: Support rails shall be smooth and any surface adjacent to them shall be free of sharp or abrasive elements per CBC Section 11B-407.4.10.2.
c. Structural Strength: Allowable stresses shall not be exceeded for materials used when a vertical or horizontal force of 250 pounds (1112 N) is applied at any point on the support rail, fastener, mounting device, or supporting structure per CBC Section 11B-407.4.10.3.

2.03 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design hydraulic passenger elevators.

B. Seismic Performance: Elevator system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and shall comply with elevator seismic requirements in ASME A17.1/CSA B44.

1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified."
2. Project Seismic Design Category: As indicated on Drawings.

    1) Elevator Component Importance Factor: 1.0.
    2) Design earthquake spectral response acceleration short period (Sds) for Project is as indicated on Drawings.
    3) Provide earthquake equipment required by ASME A17.1/CSA B44.
    4) Provide seismic switch required by ASCE/SEI 7.

2.04 REGULATORY REQUIREMENTS:

A. Comply with applicable provisions in the following:

1. 2010 ADA Standards for Accessible Design.
2. ASME A17.1/CSA B44 "Safety Code for Elevators and Escalators."

    a. Flood Hazard Area Requirements: Elevator Installer shall identify and comply with ASME A17.1 Rules 2.27.3.1.and Section 8.12.1, and related requirements, when the project site is located in a flood plain.

3. 2016 "California Building Code" (CBC), California Code of Regulations, Title 24, Part 2, Volumes 1 and 2 (Based on the 2015 "International Building Code").
4. 2016 "California Electrical Code" (CEC), California Code of Regulations, Title 24, Part 3 (Based on the 2014 "National Electrical Code").
5. 2016 "Elevator Safety Orders", California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6.
6. NFPA 70 "National Electrical Code."
7. NFPA 80 "Standard for Fire Doors and Other Opening Protectives."
8. UL, ETL, CSA or other approved testing laboratory for listed and labeled equipment including wiring, electrical devices, and entrances.
9. See Document 000125 "Applicable Codes and Standards" for additional applicable codes and standards.

B. Fire-Rated Hoistway Entrance Assemblies: Door-and-frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as close-to-neutral pressure as possible according to NFPA 252 or UL 10B.

1. Fire-Protection Rating: Not less than 1-1/2 hours.

2.05 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Recycled Content of Particleboard: Recycled content not less than 20 percent.

C. Recycled Content of Steel Products: Recycled content not less than 20 percent.

D. Particleboard:

1. Composite Wood Products: Hardwood plywood, particleboard and medium density fiberboard composite wood products used on the interior or exterior of the building shall meet the requirements for formaldehyde as specified in California Air Resources Board's (CARB) Air Toxics Control Measure (ATCM) for Composite Wood (17 CCR 93120 et seq.) per CGBC Section 5.504.4.5. Those materials not exempted under ATCM must meet the specified emission limits, as shown in CGBC Table 5.504.4.5.
2. Composite Wood Products: Products shall be made without urea formaldehyde.
3. Formaldehyde emissions shall not exceed 0.09 ppm per CGBC Table 5.504.4.5.

E. Finish Material Pollutant Control: Finish materials shall comply with CGBC Sections 5.504.4.1 through 5.504.4.6 per CGBC Section 5.504.4.

1. Adhesives, Sealants, and Caulks: Adhesives, sealants, and caulks used on the project shall meet the requirements of the following standards per CGBC Section 5.504.4.1:

   a. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in CBC Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products specified in subparagraph below.
   b. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

2. Paints and Coatings: Architectural paints and coatings shall comply with VOC limits in Table 1 of the ARB Architectural Coatings Suggested Control Measure, as shown in CGBC Table 5.504.4.3, unless more stringent local limits apply. The VOC content limit for coatings that do not meet the definitions for the specialty coatings categories listed in CGBC Table 5.504.4.3 shall be determined by classifying the coating as a Flat, Nonflat, or Nonflat-High Gloss coating, based on its gloss, as defined in Subsections 4.21, 4.36, and 4.37 of the 2007 California Air Resources Board Suggested Control Measure, and the corresponding Flat, Nonflat, or Nonflat-High Gloss VOC limit in CGBC Table 5.504.4.3 shall apply per CGBC Section 5.504.4.3.

3. Adhesives shall comply with maximum VOC limits listed in CGBC Table 5.504.4.1.
4. Sealants and sealant primers shall comply with maximum VOC limits listed in CGBC Table 5.504.4.2.
5. Architectural paints and coatings shall comply with maximum VOC limits listed in CGBC Table 5.504.4.3

F. Adhesives: Do not use adhesives that contain urea formaldehyde.

G. Low-Emitting Materials: Adhesives shall comply with the requirements of authorities having jurisdiction.

H. Low-Emitting Materials: Sealants and sealant primers shall comply with the requirements of authorities having jurisdiction.

I. Low-Emitting Materials: Paints and coatings shall comply with the requirements of authorities having jurisdiction.

2.06 ELEVATORS

A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturers' standard components shall be used, as included in standard elevator systems and as required for complete system.

B. Elevator Description:

1. Elevator Number: 1.
2. Type: Holeless, beside-the-car, telescoping, dual cylinder.
3. Rated Load: 3500 lb (1589 kg).
4. Rated Speed: 150 fpm (0.76 m/s).
5. Operation System: Selective-collective automatic operation. TAC32H.
6. Auxiliary Operations:

    a. Battery-powered lowering.
    b. Automatic dispatching of loaded car.
    c. Nuisance call cancel.
    d. Loaded-car bypass.
    e. Automatic operation of lights and ventilation fans.

7. Car Enclosures:

    a. Inside Width: 80 inches (2032 mm).
    b. Inside Depth: 65 inches (1651 mm).
    c. Inside Height: 93 inches (2362 mm).
    d. Front Walls (Return Panels): Satin stainless steel, No. 4 finish with integral car door frames.
    e. Car Fixtures: Satin stainless steel, No. 4 finish.
    f. Side and Rear Wall Panels: Plastic laminate.
    g. Reveals: Satin stainless steel, No. 4 finish.
    h. Doors Faces (Interior): Satin stainless steel, No. 4 finish.
    i. Door Sills: Aluminum, extruded, mill finish.
    j. Ceiling: Polished stainless steel, No. 8 finish.
    k. Handrails: 1-1/2 inches (38 mm) round satin stainless steel, No. 4 finish, at rear of car.
    l. Floor: Prepared to receive ceramic tile.

8. Hoistway Entrances:

    a. Width: 42 inches (1067 mm).
    b. Height: 84 inches (2134 mm).
    c. Type: Single-speed center opening.
    d. Frames: Satin stainless steel, No. 4 finish.
    e. Doors: Satin stainless steel, No. 4 finish.
    f. Door Sills: Aluminum, extruded, mill finish.

9. Hall Fixtures: Satin stainless steel, No. 4 finish.
10. Additional Requirements:

    a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish.
    b. Provide hooks for protective pads in all cars and one complete set of full-height protective pads.

2.07 MATERIALS, GENERAL

A. Colors, Patterns, and Finishes: As indicated on Drawings or, if not indicated, as selected by the Architect from manufacturer's full range.

B. Steel:

1. Shapes and Bars: Carbon.
2. Sheet: Cold-rolled steel sheet, commercial quality, Class 1, matte finish.
3. Finish:

a. Factory-applied baked enamel for structural parts.
b. Powder coat for architectural parts.

C. Plastic Laminate: Decorative high-pressure type, complying with NEMA LD3, Type GP-50 General Purpose Grade, nominal 0.048 inch (1.2 mm) thickness.

D. Finish Flooring: Comply with requirements of Section 093013 "Ceramic Tiling" for finish flooring in elevator cars.

2.08 HOISTWAY EQUIPMENT

A. Platform: Fabricated frame of formed or structural steel shapes, gusseted and rigidly welded with a wood sub-floor. Underside of the platform shall be fireproofed. The car platform shall be designed and fabricated to support one-piece loads weighing up to 25 percent of the rated capacity.

B. Sling: Steel stiles bolted or welded to a steel crosshead and bolstered with bracing members to remove strain from the car enclosure.

C. Guide Rails: Steel, omega shaped, fastened to the building structure with steel brackets.

D. Guides: Slide guides shall be mounted on top and bottom of the car.

E. Buffers: Provide substantial buffers in the elevator pit. Mount buffers on continuous channels fastened to the elevator guide rail or securely anchored to the pit floor. Provide extensions if required by project conditions.

F. Jack: A jack unit shall be of sufficient size to lift the gross load the height specified. Factory test jack to insure adequate strength and freedom from leakage. Brittle material, such as gray cast iron, is prohibited in the jack construction. Provide the following jack type:

1. Twin Post Holeless Telescopic 2-Stage: Two jacks piped together, mounted one on each side of the car with each having two telescopic sections designed to extend in a synchronized manner when oil is pumped into the assembly. Each jack section will be guided from within the casing or the plunger assembly used to house the section. Each plunger shall have a high pressure sealing system which will not allow for seal movement or displacement during the course of operation. Each jack assembly shall have a check valve built into the assembly to allow for automatically re-syncing the two plunger sections by moving the jack to its fully contracted position. The jack shall be designed to be mounted on the pit floor or in a recess in the pit floor. Each jack section shall have a bleeder valve to discharge any air trapped in the section.

G. Automatic Self-Leveling: Provide each elevator car with a self-leveling feature to automatically bring the car to the floor landings and correct for over travel or under travel. Self-leveling shall, within its zone, be automatic and independent of the operating device. The car shall be maintained approximately level with the landing irrespective of its load.

1. Automatic self-leveling shall comply with accessibility requirements.

H. Wiring, Piping, and Oil: Provide all necessary hoistway wiring in accordance with the CEC and NFPA 70. All necessary code compliant pipe and fittings shall be provided to connect the power unit to the jack unit.

I. Pit moisture/water sensor located approximately 12 inches (305 mm) above the pit floor to be provided. Once activated, elevator will perform "flooded pit operation", which will run the car up to the designated floor, cycle the doors and shut down and trip the circuit breaker shunt to remove 3 phase power from all equipment, including pit equipment.

J. Motorized oil line shut-off valve shall be provided that can be remotely operated from the controller landing service panel. Provide a means for manual operation at the valve in the pit.

2.09 POWER UNIT

A. Power Unit (Oil Pumping and Control Mechanism): A self-contained unit consisting of the following items:

1. Oil reservoir with tank cover.
2. Oil hydraulic pump.
3. Electric motor.
4. Oil control valve with the following components built into single housing:

a. High pressure relief valve.
b. Check valve.
c. Automatic unloading up start valve.
d. Lowering and leveling valve.
e. Electro-magnetic controlling solenoids.

B. Pump: Positive displacement type pump specifically manufactured for oil-hydraulic elevator service. Pump shall be designed for steady discharge with minimum pulsation to give smooth and quiet operation. Output of pump shall not vary more than 10 percent between no load and full load on the elevator car.

C. Motor: Manufacturer's Standard motor specifically designed for oil-hydraulic elevator service. Duty rating shall be selected for specified speed and load.

D. Control System: Control system shall be microprocessor based and protected from environmental extremes and excessive vibrations in a NEMA 1 enclosure.

E. Oil Control Unit: The following components shall be built into a single housing. Welded manifolds with separate valves to accomplish each function are not acceptable. Adjustments shall be accessible and be made without removing the assembly from the oil line.

1. Relief valve shall be adjustable and be capable of bypassing the total oil flow without increasing back pressure more than 10 percent above that required to barely open the valve.

2. Up start and stop valve shall be adjustable and designed to bypass oil flow during start and stop of motor pump assembly. Valve shall close slowly, gradually diverting oil to or from the jack unit(s), ensuring smooth up starts and up stops.
3. Check valve shall be designed to close quietly without permitting any perceptible reverse flow.
4. Lowering valve and leveling valve shall be adjustable for down start speed, lowering speed, leveling speed and stopping speed to ensure smooth down starts and down stops. The leveling valve shall be designed to level the car to the floor in the direction the car is traveling after slowdown is initiated.
5. Provide constant speed regulation in both up and down direction. Compensate for load changes, oil temperature, and viscosity changes.

F. Solid State Starting: Provide an electronic starter featuring adjustable starting currents.

G. Oil Type: Provide a zinc free, inherently biodegradable lubricant formulated with premium base stocks to provide outstanding protection for demanding hydraulic systems, especially those operating in environmentally sensitive areas.

2.10 HOISTWAY ENTRANCES

A. Hoistway Entrance Assemblies: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with hangers, doors, hanger supports, hanger covers, track systems, fascia plates (where required), sight guards, hardware, sills, and accessories. Frame size and profile shall accommodate hoistway wall construction.

1. Where gypsum board wall construction is indicated, frames shall be self-supporting with reinforced head sections.
2. Provide complete hollow metal type hoistway entrances at each hoistway opening bolted / knock down construction.

B. Materials and Fabrication: Manufacturer's standards, but not less than the following:

1. Stainless-Steel Frames: Formed from stainless-steel sheet.

   a. Frame Finish: Satin stainless steel, No. 4 finish.

2. Star of Life Symbol: Identify emergency elevators with star of life symbol, not less than 3 inches (76 mm) high, on both jambs of hoistway door frames.
3. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet.

   a. Door Finish: Satin stainless steel, No. 4 finish.

4. Sight Guards: Provide sight guards on doors matching door edges.
5. Sills: Extruded aluminum, with grooved surface, not less than 1/4 inch (6.4 mm) thick.

   a. Sill Finish: Mill.

6. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M.

C. Interlocks: Equip each hoistway entrance with an approved type interlock tested as required by code. Provide door restriction devices as required by code.

D. Door Hanger and Tracks: Provide sheave type two point suspension hangers and tracks for each hoistway horizontal sliding door.

1. Sheaves: Polyurethane tires with ball bearings properly sealed to retain grease.
2. Hangers: Provide an adjustable device beneath the track to limit the up-thrust of the doors during operation.
3. Tracks: Drawn steel shapes, smooth surface and shaped to conform to the hanger sheaves.

2.11 CAR ENCLOSURES

A. General: Provide enameled- or powder-coated-steel car enclosures to receive removable wall panels, with car roof, access doors, power door operators, and ventilation.

1. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.

B. Materials and Finishes: Manufacturer's standards, but not less than the following:

1. Subfloor: Exterior, C-C Plugged grade plywood, not less than 7/8 inch (22.2 mm) nominal thickness.
2. Finish Flooring: Specified in Section 093013 "Ceramic Tiling."
3. Wall Panels: Cab type TKAP, reinforced cold-rolled steel with two coats factory applied baked enamel finish, with applied vertical wood core panels covered on both sides with high pressure plastic laminate.

    a. Reveals, Base, and Frieze Finish: Satin stainless steel, No. 4 finish.

4. Canopy: Cold-rolled steel with hinged exit.
5. Fabricate car with recesses and cutouts for signal equipment.
6. Fabricate car door frame integrally with front wall of car.
7. Cab Fronts, Return, Transom, Soffit, and Strike: Provide panels faced with satin stainless steel, No. 4 finish.
8. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet. Horizontal sliding car doors reinforced with steel for panel rigidity. Hang doors on sheave type hangers with polyurethane tires that roll on a polished steel track and are guided at the bottom by non-metallic sliding guides.

    a. Door Finish: Satin stainless steel, No. 4 finish.

9. Sills: Extruded aluminum, with grooved surface, not less than 1/4 inch (6.4 mm) thick.

    a. Sill Finish: Mill.

10. Ceiling: Downlight type, metal pans with suspended LED downlights and dimmer switch. Number of downlights shall be dependent on platform size but not less than six.

    a. Light Fixture Efficiency: Not less than 35 lumens/W.
    b. Ceiling Metal Pan Finish: Polished stainless steel, No. 8 finish.

11. Handrails: Provide 1-1/2 inch (38 mm) diameter cylindrical metal handrails on side and rear walls on front opening cars.

    a. Handrail Finish: Satin stainless steel, No. 4 finish.

12. Ventilation: Manufacturer's standard exhaust fan, mounted on the car top.

    a. Ventilation Fan Efficiency: Not less than 3.0 cfm/W (1.4 L/s per W).

13. Protection Pads and Buttons: Provide one set of vinyl protection pads with metal grommets for the project. Provide pad buttons on cab fronts and walls.

C. Car Top Inspection: Provide a car top inspection station with an "Auto-Inspection" switch, an "Emergency Stop" switch, and constant pressure "Up and Down" direction and safety buttons to make the normal operating devices inoperative. The station shall give the inspector complete control of the elevator. The car top inspection station shall be mounted in the door operator assembly.

2.12 DOOR OPERATION

A. Door Operation: Provide a direct or alternating current motor driven heavy duty operator designed to operate the car and hoistway doors simultaneously. The door control system shall be digital closed loop and the closed loop circuit shall give constant feedback on the position and velocity of the elevator door. The motor torque shall be constantly adjusted to maintain the correct door speed based on its position and load. All adjustments and setup shall be through the computer based service tool. Door movements shall follow a field programmable speed pattern with smooth acceleration and deceleration at the ends of travel. The mechanical door operating mechanism shall be arranged for manual operation in event of power failure. Doors shall automatically open when the car arrives at the landing and automatically close after an adjustable time interval or when the car is dispatched to another landing. AC controlled units with oil checks, or other deviations are not acceptable.

1. No Un-Necessary Door Operation: The car door shall open only if the car is stopping for a car or hall call, answering a car or hall call at the present position or selected as a dispatch car.
2. Door Open Time Saver: If a car is stopping in response to a car call assignment only (no coincident hall call), the current door hold open time is changed to a shorter field programmable time when the electronic door protection device is activated.
3. Double Door Operation: When a car stops at a landing with concurrent up and down hall calls, no car calls, and no other hall call assignments, the car door opens to answer the hall call in the direction of the car's current travel. If an onward car call is not registered before the door closes to within 6 inches (152 mm) of fully closed, the travel shall reverse and the door shall reopen to answer the other call.
4. Nudging Operation: The doors shall remain open as long as the electronic detector senses the presence of a passenger or object in the door opening. If door closing is prevented for a field programmable time, a buzzer shall sound. When the obstruction is removed, the door shall begin to close at reduced speed. If the infra-red door protection system detects a person or object while closing on nudging, the doors shall stop and resume closing only after the obstruction has been removed.
5. Door Reversal: If the doors are closing and the infra-red beams are interrupted, the doors shall reverse and reopen. After the obstruction is cleared, the doors shall begin to close.
6. Door Open Watchdog: If the doors are opening, but do not fully open after a field adjustable time, the doors shall recycle closed then attempt to open six times to try and correct the fault.
7. Door Close Watchdog: If the doors are closing, but do not fully close after a field adjustable time, the doors shall recycle open then attempt to close six times to try and correct the fault.
8. Door Close Assist: When the doors have failed to fully close and are in the recycle mode, the door drive motor shall have increased torque applied to possibly overcome mechanical resistance or differential air pressure and allow the door to close.

B. Door Protection Device: Provide a door protection system using microprocessor controlled infra-red light beams. The beams shall project across the car opening detecting the presence of a passenger or object. If door movement is obstructed, the doors shall immediately reopen.

2.13 CAR OPERATING STATIONS

A. General: Provide car-call buttons that light when activated and remain lit until call has been fulfilled. Provide buttons and lighted elements illuminated with LEDs.

1. Buttons shall comply with accessibility requirements.
2. Buttons shall be vandal resistant type.

B. Swing-Return Car-Control Stations: Provide car-control stations mounted on rear of hinged return panel adjacent to car door and with buttons, switches, controls, and indicator lights projecting through return panel but substantially flush with face of return panel. Each button shall be provided with an internal automatic stop to prevent damage to switches.

1. Mark buttons and switches for function. Use both tactile symbols and Braille.

a. Button and switch identification shall comply with accessibility requirements.

2. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.

C. Main Car Operating Panel: The main car operating panel in each car shall contain the devices required for specific operation mounted in an integral swing return panel requiring no applied faceplate. The main car operating panel shall be mounted in the return. Pushbuttons that illuminate using long lasting LEDs shall be included for each floor served, and emergency buttons and switches shall be provided per code. Switches for car light and accessories shall be provided.

a. Main car operating panel shall comply with accessibility requirements.
b. Main Car Operating Panel Finish: Satin stainless steel, No. 4 finish.

D. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.

E. Auxiliary Operating Panel: Not required.

F. Firefighters' Two-Way Telephone Communication Service: Provide telephone jack in each car and required conductors in traveling cable for firefighters' two-way telephone communication service specified in Division 28 Sections.

G. Car Position Indicator: Provide illuminated, digital-type car position indicator, located above car door or above car-control station. Also, provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.

H. Column Mounted Car Riding Lantern: A car riding lantern shall be installed in the elevator cab and located in the entrance. The lantern, when illuminated, will indicate the intended direction of travel. The lantern will illuminate and a signal will sound when the car arrives at a floor where it will stop. The lantern shall remain illuminated until the doors begin to close.

I. Special Equipment: Not required.

2.14 OPERATION SYSTEMS

A. General: Provide manufacturer's standard microprocessor operation system as required to provide type of operation indicated.

B. Controller: The elevator control system shall be microprocessor based and software oriented. Control of the elevator shall be automatic in operation by means of push buttons in the car numbered to correspond to floors served, for registering car stops, and by "up-down" push buttons at each intermediate landing and "call" push buttons at terminal landings.

C. Automatic Light and Fan Shut Down: The control system shall evaluate the system activity and automatically turn off the cab lighting and ventilation fan during periods of inactivity. The settings shall be field programmable.

D. Emergency Power Operation (Battery Lowering 10-DOC): When the loss of normal power is detected, a battery lowering feature is to be activated. The elevator will lower to a predetermined level and open the doors. After passengers have exited the car, the doors will close and the car will shutdown. When normal power becomes available, the elevator will automatically resume operation. The battery lowering feature is included in the elevator contract and does not utilize a building-supplied standby power source.

E. Special Operation: Not required.

F. Auxiliary Operations:

1. Automatic Dispatching of Loaded Car: When car load exceeds 80 percent of rated capacity, doors start closing.
2. Nuisance Call Cancel: When car calls exceed a preset number while car load is less than a predetermined weight, all car calls are canceled. Preset number of calls and predetermined weight can be adjusted.

2.15 HALL STATIONS

A. General: Provide car-call buttons that light when activated and remain lit until call has been fulfilled. Provide buttons and lighted elements illuminated with LEDs.

1. Buttons shall comply with accessibility requirements.
2. Buttons shall be vandal resistant type.

B. Hall Push-Button Stations: Provide one hall push-button station at each hoistway entrance. Each button shall be provided with an internal automatic stop to prevent damage to switches.

1. Hall stations shall comply with accessibility requirements.
2. Hall stations shall be vandal resistant type.
3. Buttons shall comply with accessibility requirements.
4. Buttons shall be vandal resistant type.
5. Provide manufacturer's standard wall-mounted units.

    a. Hall Push-Button Station Faceplate Finish: Satin stainless steel, No. 4 finish.

6. Equip units with buttons for calling elevator and for indicating applicable direction of travel.
7. Provide telephone jack in each unit for firefighters' two-way telephone communication service specified in Division 28 Sections.

8. Phase 1 firefighter's service key switch, with instructions, shall be incorporated into the hall station at the designated level.

C. Floor Identification Pads: Provide floor identification pads on door jamb at each hoistway entrance.

1. Floor identification pads shall comply with accessibility requirements.

D. Hall Position Indicators: An electronic dot matrix position indicator shall be provided at each hoistway entrance, mounted for optimum viewing. As the car travels, its position in the hoistway shall be indicated by the illumination of the alphanumeric character corresponding to the landing where the elevator is stopped or the landing the elevator passing. When hall lanterns are provided, the position indicator shall be combined with the hall lanterns in the same faceplate. Faceplates shall match hall stations.

1. Hall position indicators shall comply with accessibility requirements.
2. Hall position indicators shall be vandal resistant type.
3. Provide manufacturer's standard wall-mounted units.

E. Hall Lanterns: Provide units with illuminated arrows; however, provide single arrow at terminal landings. A hall lantern with adjustable chime shall be provided at each hoistway entrance, located adjacent to the entrance. Hall lanterns, when illuminated, shall indicate the elevator car that shall stop at the landing and in what direction the car is set to travel. When the car reaches a predetermined distance from the floor where it is going to stop, the corresponding hall lantern shall illuminate and the chime shall sound. Hall lantern shall remain illuminated until the car doors close in preparation for leaving the floor. Illumination of the arrow shall be with LEDs. Faceplates shall match the hall station finish.

1. Hall lanterns shall comply with accessibility requirements.
2. Hall lanterns shall be vandal resistant type.
3. Provide manufacturer's standard wall-mounted units.

F. Emergency Pictorial Signs: Fabricate from materials matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire, elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station unless otherwise indicated.

G. Special Equipment: Not required.

2.16 MISCELLANEOUS ELEVATOR COMPONENTS

A. Oil Hydraulic Silencer: Install multiple oil hydraulic silencers (muffler device) at the power unit location. The silencers shall contain pulsation absorbing material inserted in a blowout proof housing.

2.17 FINISH MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, commercial steel, Type B, exposed, matte finish.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, commercial steel, Type B, pickled.

C. Stainless-Steel Sheet: ASTM A240/A240M, Type 304.

D. Stainless-Steel Tubing: ASTM A554, Grade MT 304.

E. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063.

F. Plastic Laminate: High-pressure type complying with NEMA LD 3, Type HGS for flat applications and Type BKV for panel backing.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Verify critical dimensions and examine supporting structure and other conditions under which elevator work is to be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install elevator systems components and coordinate installation of hoistway wall construction.

1. Work shall be performed by competent elevator installation personnel in accordance with ASME A17.1/CSA B44, manufacturer's installation instructions and approved shop drawings.
2. Comply with the CEC and NFPA 70 for electrical work required during installation.

B. For Applications Where Jack Hole is Required:

1. Drill or otherwise excavate below elevator pit construction as required to install the jack unit.
2. Install casing for jack unit.
3. Provide HDPE jack protection system for all in ground jacks.
4. Set casing for jack unit assembly plumb, and partially fill with water settled sand, eliminating voids. Back fill depth shall be sufficient to hold the bottom of the jack in place over time.

C. Install cylinder plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor and braced at intervals as needed to maintain alignment. Anchor cylinder guides at spacing needed to maintain alignment and avoid overstressing guides.

D. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS workmanship and welding operator qualification standards.

E. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.

F. Install machinery, guides, controls, car and all equipment and accessories to provide a quiet, smoothly operating installation, free from side sway, oscillation or vibration.

G. Install piping above the floor, where possible. Install underground piping in casing.

H. Lubricate operating parts of systems as recommended by manufacturers.

I. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay final adjustment of sills, frames, and doors until car is operable in shaft. Reduce clearances to minimum safe, workable dimensions at each landing.

J. Erect hoistway sills, headers, and frames before erection of rough walls and doors; erect fascia and toe guards after rough walls finished.

K. Leveling Tolerance: 1/4 inch (6 mm), up or down, regardless of load and travel direction.

1. Leveling shall comply with accessibility requirements.

L. Set sills accurately aligned and slightly above finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.

M. Locate hall signal equipment for elevators as follows unless otherwise indicated:

1. Locate hall push-button stations at location most convenient for approaching passengers.
2. Place hall lanterns either above or beside each hoistway entrance.
3. Mount hall lanterns not less than 72 inches (1829 mm) above finished floor.

3.03 FIELD QUALITY CONTROL

A. Inspection and Testing:

1. Elevator Installer shall obtain and pay for all required inspections, tests, permits and fees for elevator installation.
2. Arrange for inspections and make required tests.
3. Deliver to the Owner upon completion and acceptance of elevator work.

B. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by authorities having jurisdiction.

C. Advise Owner, Contractor, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

3.04 ADJUSTING

A. Make necessary adjustments of operating devices and equipment to ensure elevator operates smoothly and accurately.

3.05 CLEANING

A. Before final acceptance, remove protection from finished surfaces and clean and polish surfaces in accordance with manufacturer's recommendations for type of material and finish provided. Stainless steel shall be cleaned with soap and water and dried with a non-abrasive material.

1. Stainless steel shall not be cleaned with bleach-based cleansers.
2. Use environmentally preferable and low VOC emitting cleaners for each application type. Cleaners that contain solvents, pine and/or citrus oils are not permitted.

B. At completion of elevator work, remove tools, equipment, and surplus materials from site. Clean equipment rooms and hoistway. Remove trash and debris.

3.06 PROTECTION

A. At completion of elevator work, or portion thereof, provide suitable protective coverings, barriers, devices, signs, or other such methods or procedures to protect elevator work from damage or deterioration. Maintain protective measures throughout remainder of construction period.

B. Temporary Use: Comply with the following requirements for each elevator used for construction purposes:

1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
2. Provide strippable protective film on entrance and car doors and frames.
3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
5. Do not load elevators beyond their rated weight capacity.
6. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleanup, and adjustment as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
7. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3.07 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevator(s).

1. Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies.
2. Train Owner's maintenance personnel in normal procedures to be followed in checking for sources of operational failures or malfunctions.

B. Check operation of each elevator, with Owner's maintenance personnel present, before date of Substantial Completion and again not more than one month before end of warranty period. Determine that control systems and operating devices are functioning properly.

3.08 MAINTENANCE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or

replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Perform maintenance during normal working hours.
2. Manufacturer shall have a service office and full time service personnel within a 100 mile radius of the project site.
3. Perform emergency callback service during normal working hours with response time of not more than two hours.

3.09 ELEVATOR SCHEDULE

A. Elevator Quantity: 1.

1. Elevator Model: Endura, Twinpost, Above-Ground, Telescopic, 2-Stage, Model AMEE 35 HLS.
2. Elevator Type: Hydraulic Passenger.
3. Rated Load: 3500 lb (1589 kg).
4. Rated Speed: 150 fpm (0.76 m/s).
5. Operation System: TAC32H
6. Travel: 15'-0".
7. Landings: 2 total.
8. Openings:

    a. Front: 1.
    b. Rear: 0.

9. Clear Car Inside: 6' - 8" wide x 5' - 5" deep.
10. Cab Height: 8'-0" standard.
11. Hoistway Entrance Size: 3' - 6" wide x 7'-0" high.
12. Door Type: Center Opening.
13. Power Characteristics: 460 volts, 3 Phase, 60 Hz.
14. Seismic Requirements: Zone 3 plus.
15. Hoistway Dimensions: 8' - 8" wide x 6' - 11" deep.
16. Pit Depth: 4' - 0".
17. Button and Fixture Style: Signa4 Signal Fixtures.
18. Special Operations: Not required.

END OF SECTION 142400

SECTION 21 00 50 - COMMON WORK RESULTS FOR FIRE SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. General requirements applicable to all Division 21 Sections.

1.2 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. This Section is part of each Division 21 Section.

1.3 ADDITIONAL REQUIREMENTS

A. Furnish and install incidental work not shown or specified necessary to provide a complete and workable system.

B. Make temporary connections required to maintain services during the course of the Contract without additional cost to Owner. Notify Owner seven days in advance before interrupting services.

1.4 REFERENCES AND STANDARDS

A. Where material or equipment is specified to conform to referenced standards, it shall be assumed that the most recent edition of the standard in effect at time of bid shall be used.

1. ANSI - American National Standards Institute.
2. ASTM - American Society for Testing and Materials.
3. CCR - California Code of Regulations.

    a. Title 8 - Division of Industrial Safety, Subchapter 7; General Industry Safety Orders, Articles 31 through 36.

4. NCPWB - National Certified Pipe Welding Bureau.
5. CEC - California Electrical Code.
6. NEMA - National Electrical Manufacturers' Association.
7. NFPA - National Fire Protection Association, as amended by the CBC.
8. OSHA - Occupational Safety and Health Act.
9. UL - Underwriters' Laboratories, Inc.

B. Requirements of Regulatory Agencies:

1. The publications listed below form part of this specification; comply with provisions of these publications except as otherwise shown or specified.
2. [Code editions shall be as noted on Drawings, as adopted by the California Division of the State Architect (DSA).]

a. California Building Code.
b. California Electrical Code.
c. California Energy Code.
d. California Fire Code.
e. California Green Building Standards Code.
f. California Mechanical Code.
g. California Plumbing Code.
h. California Code of Regulations, Title 24.
i. California Health and Safety Code.
j. CAL-OSHA.
k. California State Fire Marshal, Title 19 CCR.
l. National Fire Protection Association.
m. Occupational Safety and Health Administration.
n. Other applicable state laws.

3. Nothing in Drawings or specifications shall be construed to permit work not conforming to these codes, or to requirements of authorities having jurisdiction. It is not the intent of Drawings or specifications to repeat requirements of codes except where necessary for clarity.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Sequencing:

1. It is expected that the Project shall progress according to the following sequence of events:

a. Upon award of bid, Contractor shall begin preparing coordination drawings. See Coordination Article.
b. Completed coordination drawings shall be submitted to Architect for review. See Submittals Article in this Section and in Section 21 00 50.
c. Engineer will determine need for Project re-submittal to DSA:

1) No DSA re-submittal required: Coordination drawings will be returned to Contractor with comments noted and Contractor shall proceed with fabrication and erection of system in accordance with Contract Documents and reviewed submittal.
2) DSA re-submittal required: Engineer will incorporate changes depicted in coordination drawings into Contract Drawings and hydraulic calculations for re-submittal to DSA. Upon DSA approval of re-submittal, Contractor shall proceed with fabrication and erection of system in accordance with modified Contract Documents.

d. Contractor shall issue Request for Information (RFI) for each field change required after approval of coordination drawings or approval of DSA re-submittal has been obtained. Contractor shall not proceed with changes prior to RFI response.
e. Contractor shall inform Architect immediately if deviating from this sequence of events.

2. The coordination process may not be used to redesign an automatic fire sprinkler system by the Contractor. Only those changes required for coordination with the work of other trades will be allowed.

B. Coordination:
1. Coordinate Work in this Section with trades covered in other Sections of Specifications to provide a complete and operable installation of highest quality workmanship.

2. Coordinate location of fire protection piping, mains and branches, to avoid interference with work by other trades. Plumbing drainage piping and ductwork shall have right-of-way over fire protection piping. Wherever conflicts exist, fire protection piping shall be offset or rerouted at no additional cost to Owner. Provide locations of piping for use in Coordinated Layout specified in Section 23 80 00.
3. Piping shall be concealed, except where so indicated or where absolutely necessary to be exposed. Exposed piping shall be placed as approved by Architect prior to installation. Heads shall be fully coordinated with architectural reflected ceiling plan and placed in center of ceiling tiles.
4. On-site measurement of pipe will be required. Offsets, pipe, fittings, drains, etc., required to meet job conditions shall be furnished and installed at no extra cost to Owner.
5. Additional heads required by NFPA 13 regulations shall be provided at no extra cost, if required as a result of Contractors' coordination. Location of heads and mains shall not be changed unless approved by Architect.
6. Coordinate layout and installation of sprinklers with other construction penetrating ceilings, including light fixtures, HVAC equipment, and partition assemblies.
7. The Architect shall decide any differences or disputes concerning coordination, interference or extent of work, and his decision shall be final.
8. Contract Drawings are schematic. Rerouting of pipe and the addition, deletion or relocation of sprinkler heads may be necessary. Contractor shall prepare coordination drawings documenting changes. Contractor shall not proceed with fabrication or installation of fire protection system prior to approval of coordination drawings by Architect.

    a. Re-submittal of revised Contract Drawings and calculations to DSA will be required when changes to the system design, made during Project coordination phase, alter parameters used in calculations furnished to DSA for permitting purposes. If re-submittal to DSA is required, mechanical Engineer shall prepare revised Drawings and hydraulic calculations. Contractor shall not proceed with fabrication or installation of fire protection system prior to approval of revised calculations by DSA.
    b. Contractor-proposed changes to supports, anchorages, and seismic restraints for fire protection system shall conform to the following.

        1) Calculations performed for use in selection of supports, anchorages, and seismic restraints shall utilize criteria indicated in Structural Contract Documents.
        2) Supports, anchorage and seismic restraints for piping and equipment shall be an OSHPD pre-approved system such as Tolco, Afcon, ISAT, Badger, Mason, or equal. Pipes and equipment shall be seismically restrained in accordance with requirements of current editions of California Building Code and NFPA 13. System shall have current OPM number and shall meet additional requirements of authority having jurisdiction. Provide supporting documentation required by the reviewing authority and the Architect and Engineer. Provide layout drawings showing piping and restraint locations.

            a) Bracing of Piping and Equipment: Specifically state how bracing attachment to structure is accomplished. Provide shop drawings indicating seismic restraints, including details of anchorage to building. In-line equipment must be braced independently of piping, and in conformance with applicable building codes. Provide calculations to show that pre-approval numbers have been correctly applied in accordance with general information notes of pre-approval documentation.

        3) In lieu of the above or for non-standard installations not covered in the above pre-approved systems, Contractor shall provide layout drawings showing piping, equipment, and restraint locations, and detailing supports, attachments and restraints. Furnish supporting calculations and legible details sealed by a California registered structural engineer, in accordance with California Building Code, and NFPA 13.

4) Additional Requirements: In addition to the above, conform to State and local requirements.

1.6 DRAWINGS

A. Examine Contract Documents prior to bidding of Work and report discrepancies in writing to Architect.

B. Contractor shall visit Project site and examine existing conditions in order to become familiar with Project scope. Verify dimensions shown on Drawings at Project site. Bring discrepancies to the attention of Architect. Failure to examine Project site shall not constitute basis for claims for additional work because of lack of knowledge or location of hidden conditions that affect Project scope.

C. Drawings showing location of equipment and materials are diagrammatic and job conditions will not always permit installation in location shown. The fire protection Drawings show general arrangement of equipment and materials, etc., and shall be followed as closely as existing conditions, actual building construction, and work of other trades permit.

1. Architectural and structural Drawings are part of the Work. These Drawings furnish Contractor with information relating to design and construction of the Project. Architectural Drawings take precedence over fire protection Drawings.
2. Because of the small scale of fire protection Drawings, not all offsets, fittings, and accessories required are shown. Investigate structural and finish conditions affecting the Work and arrange Work accordingly. Provide offsets, fittings, and accessories required to meet conditions. Inform Architect immediately when job conditions do not permit installation of equipment and materials in locations shown. Obtain Architects' approval prior to relocation of equipment and materials.
3. Relocate equipment and materials installed without prior approval of Architect. Remove and relocate equipment and materials at Contactors' expense upon Architects' direction.
4. Minor changes in locations of equipment, piping, ducts, etc., from locations shown shall be made when directed by the Architect at no additional cost to the Owner providing such change is ordered before such items of work, or work directly connected to same are installed and providing no additional material is required.

D. Execute work mentioned in Specifications and not shown on Drawings, or vice versa, the same as if specifically mentioned or shown in both.

1.7 FEES AND PERMITS

A. Obtain and pay for permits and service required in installation of the Work. Arrange for required inspections and secure approvals from authorities having jurisdiction. Comply with the requirements of Division 01.

B. Arrange for utility connections and pay charges incurred, including excess service charges.

1. Contractor shall bear the cost of construction related to utility services, from point of connection to utility services shown on Contract Documents. This includes piping, excavation, backfill, meters, boxes, check valves, backflow prevention devices, general service valves, concrete work, and the like, whether or not Work is performed by Contractor, local water/sanitation district, public utility, other governmental agencies or agencies' assigns.

1.8 SUBMITTALS - GENERAL

A. Provide submittal of materials proposed for use as part of this Project. Product names in Specifications and on Drawings are used as standards of quality. Furnish standard items on specified equipment at no extra cost to

the Contract regardless of disposition of submittal data. Other materials or methods shall not be used unless approved in writing by Architect. Architect's review will be required even though "or equal" or synonymous terms are used. Refer to Section 01 33 00, “Submittal Procedures” for complete instructions.

1. Partial or incomplete submittals will not be reviewed.
2. Quantities are Contractor's responsibility and will not be reviewed.
3. Provide materials of same brand or manufacturer for each class of equipment or material.
4. Identify each item by manufacturer, brand, trade name, number, size, rating, or other data necessary to properly identify and review materials and equipment. Words "as specified" are not sufficient identification.
5. Identify each submittal item by reference to items’ Specification Section number and paragraph, by Drawing and detail number, and by unit tag number.
6. Organize submittals in same sequence as in Specification Sections.
7. Show physical arrangement, construction details, finishes, materials used in fabrications, provisions for piping entrance, access requirements for installation and maintenance, physical size, mechanical characteristics, foundation and support details, and weight.

    a. Submit shop drawings, performance curves, and other pertinent data, showing size and capacity of proposed materials.
    b. Specifically indicate, by drawn detail or note, that equipment complies with each specifically stated requirement of Contract Documents.
    c. Drawings shall be drawn to scale and dimensioned (except schematic diagrams). Drawings may be prepared by vendor but must be submitted as instruments of Contractor, thoroughly checked and signed by Contractor before submission to Architect for review.
    d. Catalog cuts and published material may be included with supplemental scaled drawings.

B. Review of submittals will be only for general conformance with design concept and general compliance with information given in Contract Documents. Review will not include quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with work of other trades, or construction safety precautions, which are sole responsibility of Contractor. Review of a component of an assembly does not indicate acceptance of an assembly. Deviations from Contract Documents not clearly identified by Contractor are Contractor’s responsibility and will not be reviewed by Architect.

C. Within reasonable time after award of contract and in ample time to avoid delay of construction, submit to Architect shop drawings or submittals on all items of equipment and materials provided. Provide submittal in at least seven copies and in complete package.

1. Shop drawings and submittals shall include Specification Section, Paragraph number, and Contract Drawing unit symbol or detail number for reference. Organize submittals into booklets for each Specification section and submit in loose-leaf binders with index. Deviations from Contract Documents shall be clearly identified and appear at the beginning of submittal package, and shall be referenced to applicable Contract Documents requirements.

D. Furnish to Project Inspector complete installation instructions on material and equipment before starting installation.

1.9 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for fire protection systems materials and products.

B. Shop Drawings.

C. Provide product data for insulation products, including insulation, insulation facings, jackets, adhesives, sealants, and coatings, indicating compliance with requirement that these products contain less than 0.1 percent (by mass) polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations.

D. Product Data for California Green Building Standards Code Compliance: For adhesives and sealants, including primers, documentation of compliance including printed statement of VOC content and chemical components.

1.10 INFORMATIONAL SUBMITTALS

A. Provide layouts for fire protection systems, for inclusion in coordinated layout specified in Section 23 31 13. Comply with requirements for layouts specified in Section 23 31 13.

B. Provide coordination drawings for fire protection systems in accordance with the requirements of Specification Section 21 13 13.

1.11 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Refer to Section 01 77 00, “Closeout Procedures” for complete instructions.

2. Furnish three complete sets of Operating and Maintenance Manual bound in hardboard binder, and one compact disc containing complete Operating and Maintenance Manual in searchable PDF format. Provide Table of Contents. Provide index tabs for each piece of equipment in binder and disc. Start compiling data upon approval of submittals.

a. Sets shall incorporate the following:

1) Product Data.
2) Shop Drawings.
3) Record Drawings.
4) Service telephone number, address and contact person for each category of equipment or system.
5) Complete operating instructions for each item of fire sprinkler system.

a) Original manual of NFPA-25 for fire sprinkler system.

6) Copies of guarantees/warrantees for each item of equipment or systems.
7) Test data as specified.
8) Typewritten maintenance instructions for each item of equipment listing lubricants to be used, frequency of lubrication, inspections required, adjustment, etc.
9) Manufacturers' bulletins with parts numbers, instructions, etc., for each item of equipment.
10) A complete list or schedule of scheduled valves giving the number of the valve, location and the rooms or area controlled by the valve. Identify each valve with a permanently attached metal tag stamped with number to match schedule. Post list in frame under plastic on wall in mechanical room or where directed by Architect.]
11) Check test and start reports for each piece of fire protection equipment provided as part of the Work.
12) Commissioning and Preliminary Operation Tests required as part of the Work.

b. Post service telephone numbers and addresses in an appropriate place designated by Architect.

B. Record Drawings:

1. Refer to Division 01, Record Documents, for requirements governing Work specified herein.
2. Upon completion of the work, deliver to Architect the following:

a. Originals of drawings showing the Work exactly as installed.
b. One complete set of reproducible drawings showing the Work exactly as installed.
c. One compact disc with complete set of drawings in PDF format showing the Work exactly as installed.
d. Provide Contractor's signature, verifying accuracy of record drawings.
e. Obtain the signature of the Project Inspector for all record drawings.

1.12 SUBSTITUTIONS

A. Refer to Section 01 25 00, Substitution Procedures, for complete instructions. Requirements given below are in addition to or are intended to amplify Division 01 requirements. In case of conflict between requirements given in this Section and those of Division 01, Division 01 requirements shall apply.

B. It is the responsibility of Contractor to assume costs incurred because of additional work and or changes required to incorporate proposed substitute into the Project. Refer to Division 01 for complete instructions.

C. Substitutions will be interpreted to be manufacturers other than those specifically listed in Contract Documents by brand name, model, or catalog number.

D. Only one request for substitution will be considered for each item of equipment or material.

E. Substitution requests shall include the following:

1. Reason for substitution request.
2. Complete submittal information as described herein; see "Submittals."
3. Coordinated scale layout drawings depicting position of substituted equipment in relation to other work, with required clearances for operation, maintenance and replacement.
4. List optional features required for substituted equipment to meet functional requirements of the system as indicated in Contract Documents.
5. Explanation of impact on connected utilities.
6. Explanation of impact on structural supports.

F. Installation of reviewed substitution is Contractors' responsibility. Any mechanical, electrical, structural, or other changes required for installation of substituted equipment or material must be made by Contractor without additional cost to Owner. Review by Architect of substituted equipment or material, will not waive these requirements.

G. Contractor may be required to compensate Architect for costs related to substituted equipment or material.

1.13 QUALITY ASSURANCE

A. For installing contractor qualifications refer to Section 21 13 13, "Wet-Pipe Sprinkler Systems."

1.14 DELIVERY, STORAGE, AND HANDLING

A. Protect equipment and materials delivered to Project site from weather, humidity and temperature variations, dirt, dust and other contaminants.

1.15 FIELD CONDITIONS

A. Information on Drawings relative to existing conditions is approximate. Deviations from Drawings necessary during progress of construction to conform to actual conditions shall be approved by Architect and shall be made without additional cost to Owner. The Contractor shall be held responsible for damage caused to existing services. Promptly notify Architect if services are found which are not shown on Drawings.

1.16 WARRANTY

A. Refer to Division 01 for warranty requirements, including effective date of warranty. Refer to specific items of equipment specified herein for warranty duration if different from that specified in Division 01.

B. Repair or replace defective work, material, or part that appears within warranty period, including damage caused by leaks.

C. On failure to comply with warranty requirements within a reasonable length of time after notification is given, Architect/Owner shall have repairs made at Contractor's expense.

1.17 COORDINATION

A. General:

1. Coordinate Work in this Section with trades covered in other Specification Sections to provide a complete and operable installation of highest quality workmanship.

B. Electrical Coordination:

1. Refer to Section 26 05 30, “Conduit and Wire,”, for service voltage and power feed wiring for equipment specified in this Section. Contractor has full responsibility for the following items of work:

    a. Review the Electrical Drawings and Division 26 Specifications to verify that electrical services provided are adequate and compatible with equipment requirements.
    b. If additional electrical services are required above that indicated on Electrical Drawings and in Division 26, such as more control interlock conductors, larger feeder, or separate 120 volt control power source, include cost to furnish and install additional electrical services as part of bid.
    c. Prior to proceeding with installation of additional electrical work, submit detailed drawings indicating exact scope of additional electrical work.

C. Mechanical Coordination:

1. Arrange for pipe spaces, chases, slots and openings in building structure during progress of construction, to accommodate mechanical system installation.
2. Coordinate installation of supporting devices. Set sleeves in poured-in-place concrete and other structural components during progress of construction.
3. Coordinate requirements for access panels and doors for mechanical items requiring access where concealed behind finished surfaces.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials or equipment of the same type shall be of the same brand wherever possible. All materials shall be new and in first class condition.

B. All sizes, capacities, and efficiency ratings shown are minimum.

2.2 MATERIALS

A. No material installed as part of this Work shall contain asbestos.

B. California Green Building Code Compliance:

1. Fire protection equipment shall not contain CFCs.
2. Fire protection equipment shall not contain Halons.

2.3 VALVE BOXES

A. General:

1. Where several valves or other equipment are grouped together, provide larger boxes of rectangular "vault" type adequately sized for condition and similar in construction to those specified above.
2. Provide valve box extensions as required to set bottom of valve box tight up to top of piping in which valve is installed.
3. Provide a tee handle wrench for each size, Alhambra Foundry Co. #A-3008, or equal.

B. Valve Boxes in Traffic Areas: Provide Christy No. G5 traffic valve box, Brooks, or equal, 10-3/8 inches inside diameter with extensions to suit conditions, with cast iron or steel locking cover. Provide Owner with set of special wrenches or tools as required for operation of valves.

C. Valve Boxes in Non-Traffic Areas: Provide Christy No. F22, Brooks, or equal, 8 inches inside diameter by 30 inches long, with cast iron or steel locking cover. Provide Owner with set of special wrenches or tools as required for operation of valves. Cut bottom of plastic body for operation of valves.

D. Valve Box (Rectangular Vault Type): Precast concrete or cast iron with cast iron or steel locking type covers lettered to suit service – Brooks No. 3-TL, Christy No. B3, Fraser No. 3, Alhambra A-3004 or A-3005, Alhambra E-2202, or E-2702, or equal, with extension to suit conditions.

2.4 ACCESS DOORS

A. Where floors, walls, or ceilings must be penetrated for access to fire protection equipment or devices, provide access doors, 14 inch by 14 inch minimum size in usable opening. Where entrance of a serviceman may be required, provide 20 inch by 30 inch minimum usable opening. Locate access doors/panels for non-obstructed and easy reach.

1. Access doors less than 7'-0" above floors and exposed to public access shall have keyed locks.

B. Access doors shall match those supplied in Section 08 31 13, "Access Doors and Frames," except as noted in this Section.

C. [Provide stainless steel access doors for use in toilet rooms, shower rooms, kitchens and other damp areas. Provide steel access doors with prime coat of baked-on paint for other areas.

D. Do not locate access doors in highly visible public areas such as lobbies, waiting areas, and primary entrance areas. Coordinate with Architect when access is required in these areas.

E. Where specific information or details relating to access panels different from the above is shown or given on Drawings or other Divisions of work, that information shall supersede this specification.

F. Manufacturers: Subject to compliance with requirements, available manufacturers offering products which may be incorporated into the Work include Milcor, Karp, Nystrom, or Cesco, equal to the following:

1. Milcor:

a. Style K (plaster)
b. Style DW (gypsum board)
c. Style M (masonry)
d. Style "Fire Rated" where required

PART 3 - EXECUTION

3.1 FRAMING, CUTTING AND PATCHING

A. Special framing, recesses, chases and backing for Work of this Section, unless otherwise specified, are covered under other Specification Sections.

B. Contractor is responsible for placement of pipe sleeves, hangers, inserts, supports, and location of openings for the Work.

3.2 ELECTRICAL REQUIREMENTS

A. Provide adequate working space around electrical equipment in compliance with the California Electrical Code. Coordinate the fire protection Work with the electrical Work to comply.

B. Furnish necessary control diagrams and instructions for controls. Before permitting operation of equipment which is furnished, installed, or modified under this Section, Contractor shall review associated electrical work, including overload protection devices, and assume complete responsibility for correctness of electrical connections and protective devices. Motors and control equipment shall conform to the Standards of the National Electrical Manufacturers' Association. Equipment and connections exposed to weather shall be installed in NEMA IIIR enclosures with factory wired strip heaters in each starter enclosure and temperature control panel where required to inhibit condensation.

C. All line voltage and low voltage wiring and conduit associated with fire protection system are included in this Section. Wiring and conduit shall comply with Division 26.

3.3 PIPING SYSTEM REQUIREMENTS

A. Drawing plans, schematic and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

3.4 INSTALLATION OF PIPING SYSTEMS

A. At time of final connection, and prior to opening valve to allow pressurization of water piping from existing systems, on site or off site, perform a pressure test to indicate static pressure of existing systems. If pressure on fire protection piping is greater than 175 psi, inform Architect immediately. Do not allow piping systems to be pressurized without written consent of the Architect.

B. General:

1. Piping shall be concealed unless shown or otherwise directed. Allow sufficient space for ceiling panel removal.
2. Installation of piping shall be made with appropriate fittings. Bending of piping will not be accepted.
3. Install piping to permit application of insulation where required and to allow valve servicing.
4. Where piping or conduit is left exposed within a room, the piping or conduit shall be run true to vertical, horizontal, or intended planes. Where possible, uniform margins are to be maintained between parallel lines and/or adjacent wall, floor, or ceiling surfaces.
5. Horizontal runs of pipes and/or electrical conduit suspended from ceilings shall provide for maximum headroom clearance. The clearance shall not be less than 6'-6" without written approval from Architect.
6. Close ends of pipe immediately after installation. Leave closure in place until removal is necessary for completion of installation.
7. Each piping system shall be thoroughly flushed and proved clean before connection to equipment.
8. Install exposed polished or enameled connections with special care showing no tool marks or threads at fittings.
9. Install horizontal valves with valve stem above horizontal.
10. Use reducing fittings; bushings shall not be allowed. Use eccentric reducing fittings wherever necessary to provide free drainage of lines and passage of air.
11. Verify final equipment locations for roughing-in.
12. Where piping is installed in walls within one inch of face of stud, provide 16 gauge sheet metal shield plate on face of stud. The shield plate shall extend minimum 1-1/2 inches beyond outside diameter of pipe.

3.5 ACCESS DOORS

A. Furnish and install access doors wherever required whether shown or not for easy maintenance of fire protection systems. Access doors shall provide for complete removal and replacement of equipment.

3.6 EXPANSION ANCHORS IN HARDENED CONCRETE:

A. Refer to Structural Drawings.

3.7 PRELIMINARY OPERATIONAL REQUIREMENTS AND TESTS

A. Prior to observation to determine final acceptance, put fire protection systems into service and check that work required has been done, including but not limited to the following condensed check list. Provide indexed report to tabulating the results of tests.

1. Refer to Division 21 technical Sections for specific testing requirements.
2. All equipment has been cleaned, and damaged painted finishes touched up.
3. Missing or damaged parts have been replaced.
4. Flushing of piping systems has been completed and water treatment equipment, where specified, is completed.
5. Equipment labels, pipe marker labels, ceiling markers and valve tags are installed.

6. Valve tag schedules, corrected control diagrams, sequence of operation lists and start-stop instructions have been posted.
7. Maintenance manuals have been delivered and Owner training has been completed.

B. Review of Contractor's Tests:

1. Tests made by Contractor or manufacturers' representatives are subject to observation and review by Owner. Provide timely notice prior to start of each test, in order to allow for observation of testing. Upon completion of tests, provide report to confirm that testing has been successful.

C. Test Logs:

1. Maintain test logs listing the tests on mechanical systems showing dates, items tested, inspectors' names, remarks on success or failure of tests.

3.8 COMMISSIONING

A. This Project will be commissioned by a third-party Commissioning Agent. In addition to the requirements of Division 21 Specifications, comply with the requirements of Section 01 91 13, “General Commissioning Requirements.”

END OF SECTION 21 00 50

SECTION 21 05 17 - SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

B. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

2.2 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Metraflex Company (The).
2. Pipeline Seal and Insulator, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

2. Pressure Plates: Carbon steel or Stainless steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, or Stainless steel of length required to secure pressure plates to sealing elements.

2.3 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 07 92 00 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 84 13 " Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete and CMU Walls above Grade:

   a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves.

2. Exterior Concrete and CMU Walls below Grade:

   a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves with sleeve-seal system.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

   a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves with sleeve-seal system.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

   a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.

5. Interior Partitions:

   a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.

END OF SECTION 210517

This page intentionally left blank.

SECTION 21 05 18 - ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Insulated Piping: One-piece, stamped-steel type.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
e. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
f. Bare Piping in Equipment Rooms: One-piece, cast-brass type with rough-brass finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.
2. Existing Piping: Split-casting, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 210518

SECTION 21 05 23 - GENERAL-DUTY VALVES FOR WATER-BASED FIRE SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Two-piece ball valves with indicators.
2. Bronze butterfly valves with indicators.
3. Iron butterfly valves with indicators.
4. Check valves.
5. Bronze OS&Y gate valves.
6. Iron OS&Y gate valves.
7. NRS gate valves.
8. Trim and drain valves.

1.3 DEFINITIONS

A. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

B. NRS: Nonrising stem.

C. OS&Y: Outside screw and yoke.

D. SBR: Styrene-butadiene rubber.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and weld ends.
3. Set valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

D. Protect flanges and specialties from moisture and dirt.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. UL Listed: Valves shall be listed in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:

1. Main Level: HAMV - Fire Main Equipment.

    a. Level 1: HCBZ - Indicator Posts, Gate Valve.
    b. Level 1: HLOT - Valves.

        1) Level 3: HLUG - Ball Valves, System Control.
        2) Level 3: HLXS - Butterfly Valves.
        3) Level 3: HMER - Check Valves.
        4) Level 3: HMRZ - Gate Valves.

2. Main Level: VDGT - Sprinkler System & Water Spray System Devices.

    a. Level 1: VQGU - Valves, Trim and Drain.

B. FM Global Approved: Valves shall be listed in its "Approval Guide," under the headings listed below:

1. Automated Sprinkler Systems:

    a. Indicator posts.
    b. Valves.

        1) Gate valves.
        2) Check valves.

            a) Single check valves.

        3) Miscellaneous valves.

C. Source Limitations for Valves: Obtain valves for each valve type from single manufacturer.

D. ASME Compliance:
1. ASME B16.1 for flanges on iron valves.
2. ASME B1.20.1 for threads for threaded-end valves.
3. ASME B31.9 for building services piping valves.

E. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

F. NFPA Compliance: Comply with NFPA 24 for valves.

G. Valve Pressure Ratings: Not less than the minimum pressure rating indicated or higher as required by system pressures.

H. Valve Sizes: Same as upstream piping unless otherwise indicated.

I. Valve Actuator Types:

1. Worm-gear actuator with handwheel for quarter-turn valves, except for trim and drain valves.
2. Handwheel: For other than quarter-turn trim and drain valves.
3. Handlever: For quarter-turn trim and drain valves NPS 2 and smaller.

2.2 TWO-PIECE BALL VALVES WITH INDICATORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. NIBCO INC.
2. Victaulic Company.

B. Description:

1. UL 1091, except with ball instead of disc and FM Global standard for indicating valves (butterfly or ball type), Class Number 1112.
2. Minimum Pressure Rating: 175 psig.
3. Body Design: Two piece.
4. Body Material: Forged brass or bronze.
5. Port Size: Full or standard.
6. Seats: PTFE.
7. Stem: Bronze or stainless steel.
8. Ball: Chrome-plated brass.
9. Actuator: Worm gear or traveling nut.
10. Supervisory Switch: Internal or external.
11. End Connections for Valves NPS 1 through NPS 2: Threaded ends.
12. End Connections for Valves NPS 2-1/2: Grooved ends.

2.3 BRONZE BUTTERFLY VALVES WITH INDICATORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Globe Fire Sprinkler Corporation.
2. Milwaukee Valve Company.

B. Description:

1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 1112.
2. Minimum: Pressure rating: 175 psig.
3. Body Material: Bronze.
4. Seat Material: EPDM.
5. Stem Material: Bronze or stainless steel.
6. Disc: Bronze or Stainless steel.
7. Actuator: Worm gear or traveling nut.
8. Supervisory Switch: Internal or external.
9. Ends Connections for Valves NPS 1 through NPS 2: Threaded ends.
10. Ends Connections for Valves NPS 2-1/2: Grooved ends.

2.4 IRON BUTTERFLY VALVES WITH INDICATORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Anvil International; a subsidiary of Mueller Water Products, Inc.
2. Globe Fire Sprinkler Corporation.
3. Tyco Fire & Building Products LP.

B. Description:

1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 112.
2. Minimum Pressure Rating: 175 psig.
3. Body Material: Cast or ductile iron.
4. Seat Material: EPDM.
5. Stem: Stainless steel.
6. Disc: Ductile iron, nickel plated.
7. Actuator: Worm gear or traveling nut.
8. Supervisory Switch: Internal or external.
9. Body Design: Lug or wafer, or Grooved-end connections.

2.5 CHECK VALVES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Anvil International; a subsidiary of Mueller Water Products, Inc.
2. Globe Fire Sprinkler Corporation.
3. Tyco Fire & Building Products LP.
4. Viking Corporation.

B. Description:
1. Standard: UL 312 and FM Global standard for swing check valves, Class Number 1210.
2. Minimum Pressure Rating: 175 psig.
3. Type: Single swing check.
4. Body Material: Cast iron, ductile iron, or bronze.
5. Clapper: Bronze, ductile iron, or stainless steel.

6. Clapper Seat: Brass, bronze, or stainless steel.
7. Hinge Shaft: Bronze or stainless steel.
8. Hinge Spring: Stainless steel.
9. End Connections: Flanged, grooved, or threaded.

2.6 BRONZE OS&Y GATE VALVES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Milwaukee Valve Company.
2. NIBCO INC.
3. Zurn Industries, LLC.

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Bronze or brass.
4. Wedge: One-piece bronze or brass.
5. Wedge Seat: Bronze.
6. Stem: Bronze or brass.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Threaded.

2.7 IRON OS&Y GATE VALVES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Hammond Valve.
2. Mueller Co.
3. Victaulic Company.

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron, or bronze.
5. Wedge Seat: Cast or ductile iron, or bronze.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Flanged, Grooved, or Threaded.

2.8 NRS GATE VALVES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Mueller Co.
2. Victaulic Company.

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron.
5. Wedge Seat: Cast or ductile iron, or bronze.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Flanged, Grooved, or Threaded.

2.9 TRIM AND DRAIN VALVES

A. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Tyco Fire & Building Products LP.
b. Victaulic Company.

2. Description:

a. Pressure Rating: 175 psig
b. Body Design: Two piece.
c. Body Material: Forged brass or bronze.
d. Port size: Full or standard.
e. Seats: PTFE.
f. Stem: Bronze or stainless steel.
g. Ball: Chrome-plated brass.
h. Actuator: Handlever.
i. End Connections for Valves NPS 1 through NPS 2-1/2: Threaded ends.
j. End Connections for Valves NPS 1-1/4 and NPS 2-1/2: Grooved ends.

B. Angle Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Fire Protection Products, Inc.
b. NIBCO INC.

c. United Brass Works, Inc.

2. Description:

a. Pressure Rating: 175 psig.
b. Body Material: Brass or bronze.
c. Ends: Threaded.
d. Stem: Bronze.
e. Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron, bronze, or aluminum.

C. Globe Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. NIBCO INC.
b. United Brass Works, Inc.

2. Description:

a. Pressure Rating: 175 psig.
b. Body Material: Bronze with integral seat and screw-in bonnet.
c. Ends: Threaded.
d. Stem: Bronze.
e. Disc Holder and Nut: Bronze.
f. Disc Seat: Nitrile.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 GENERAL REQUIREMENTS FOR VALVE INSTALLATION

A. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

B. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

C. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal without system shutdown. Provide separate support where necessary.

D. Install valves in horizontal piping with stem at or above the pipe center.

E. Install valves in position to allow full stem movement.

F. Install valve tags. Comply with requirements in Section 210553 "Identification for Fire-Suppression Piping and Equipment" for valve tags and schedules and signs on surfaces concealing valves; and the NFPA standard applying to the piping system in which valves are installed. Install permanent identification signs indicating the portion of system controlled by each valve.

G. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections.

H. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

END OF SECTION 210523

SECTION 210548 - VIBRATION AND SEISMIC CONTROLS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipe-riser resilient supports.
2. Resilient pipe guides.
3. Elastomeric hangers.
4. Snubbers.
5. Restraint channel bracings.
6. Seismic-restraint accessories.
7. Mechanical anchor bolts.

B. Related Requirements:

1. Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for devices for plumbing equipment and systems.
2. Section 23 05 48 "Vibration and Seismic Controls for HVAC" for devices for HVAC equipment and systems.

1.3 DEFINITIONS

A. OSHPD: Office of Statewide Health Planning & Development (for the State of California).

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.

    a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by OSHPD.
    b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for fire-suppression piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any. Refer to Section 21 00 50, “Common Work Results for Fire Suppression Systems,” for additional requirements.

B. Qualification Data: For professional engineer and testing agency.

C. Welding certificates.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the CBC unless requirements in this Section are more stringent.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPM number from OSHPD, showing maximum seismic-restraint ratings. If preapproved ratings are unavailable, provide calculations (including combining shear and tensile loads) to support seismic-restraint designs signed and sealed by a qualified structural engineer registered in the State of California. For additional requirements, refer to Section 21 00 50, “Common Work Results for Fire Suppression System.”

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Refer to structural Drawings.
2. Rated strengths, features, and applications shall be as defined in reports by OSHPD or provide calculations, signed and sealed by a qualified structural engineer registered in the State of California.

    a. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they are subjected.

2.2 PIPE-RISER RESILIENT SUPPORT

A. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch-thick neoprene.

1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
2. Maximum Load Per Support: 500 psig on isolation material providing equal isolation in all directions.

2.3 RESILIENT PIPE GUIDES

A. Description: Telescopic arrangement of two steel tubes or post-and-sleeve arrangement separated by a minimum 1/2-inch-thick neoprene.

1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.4 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. Kinetics Noise Control, Inc.
   b. Mason Industries, Inc.
   c. Vibration Eliminator Co., Inc.
   d. Vibration Mountings & Controls, Inc.

2. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
3. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

2.5 RESTRAINT CHANNEL BRACINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. B-line, an Eaton business.
2. Hilti, Inc.
3. Mason Industries, Inc.
4. Unistrut; an Atkore International company.

B. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.6 SEISMIC-RESTRAINT ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. B-line, an Eaton business.
2. Kinetics Noise Control, Inc.
3. Mason Industries, Inc.
4. TOLCO.

B. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections, or Reinforcing steel angle clamped to hanger rod.

C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings.

D. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.7 MECHANICAL ANCHOR BOLTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. B-line, an Eaton business.
2. Hilti, Inc.
3. Kinetics Noise Control, Inc.
4. Mason Industries, Inc.

B. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by OSHPD or an agency acceptable to authorities having jurisdiction.

B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. All seismic restraint devices shall be installed in accordance with their listings.

B. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 03 30 00 "Cast-in-Place Concrete."

C. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

D. Equipment Restraints:

1. Install seismic-restraint devices using methods approved by OSHPD.

E. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
3. Brace a change of direction longer than 12 feet.

F. Install seismic-restraint devices using methods approved by OSHPD.

G. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

H. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

I. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

J. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 211200 "Fire-Suppression Standpipes," and Section 211313 "Wet-Pipe Sprinkler Systems," for piping flexible connections.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

END OF SECTION 210548

This page intentionally left blank.

SECTION 21 05 53 - IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Valve tags.
5. Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.

C. Valve Schedules: Valve numbering scheme.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Brimar Industries, Inc.
   b. Marking Services, Inc.
   c. Seton Identification Products.

2. Material and Thickness: Brass, 0.032 inch, or stainless steel, 0.025 inch thick, with predrilled holes for attachment hardware.
3. Letter Color: Black.
4. Background Color: White.

5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

2.2 WARNING SIGNS AND LABELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Brimar Industries, Inc.
2. Marking Services Inc.
3. Seton Identification Products.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.

C. Letter Color: Red.

D. Background Color: White.

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

H. Fasteners: Stainless-steel rivets or self-tapping screws.

I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

J. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Brimar Industries, Inc.
2. Marking Services Inc.
3. Seton Identification Products.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction according to ASME A13.1.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to fit circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping.

E. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.

F. Valve Schedules: Valve numbering scheme.

G. Pipe-Label Colors:

1. Background Color: Safety Red.
2. Letter Color: White.

2.4 VALVE TAGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Brimar Industries, Inc.
2. Marking Services Inc.
3. Seton Identification Products.

B. Description: Stamped or engraved with 1/4-inch letters for piping-system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032 inch thick, with predrilled holes for attachment hardware.
2. Fasteners: Brass wire-link chain or beaded chain.

C. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.5 WARNING TAGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Brimar Industries, Inc.
2. Marking Services Inc.
3. Seton Identification Products.

B. Description: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Safety Yellow background with black lettering.

2.6 ACOUSTICAL CEILING LABELS

A. Provide 1/16 inch thick white nameplate with black letters to identify access to concealed valves or equipment requiring service where located above acoustical ceiling tiles. The nameplate shall be 3/4 inch high by 2-1/2 inches wide. Coordinate the information to be engraved on each plate so that it exactly matches the valve tag or equipment nameplate. The minimum letter height shall be 1/4 inch.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.

2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit a view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes including pipes where flow is allowed in both directions.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in fire-suppression piping systems. List tagged valves in a valve-tag schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:

1. Valve-Tag Size and Shape:

a. Wet-Pipe Sprinkler System: 1-1/2 inches, round.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 210553

This page intentionally left blank.

SECTION 211200 - FIRE-SUPPRESSION STANDPIPES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Fire-protection specialty valves.
3. Hose connections.
4. Alarm devices.
5. Manual control stations.
6. Control panels.
7. Pressure gages.

B. Related Requirements:

1. Section 210523 "General-Duty Valves for Water-Based Fire-Suppression Piping."
2. Section 211313 "Wet-Pipe Sprinkler Systems" for wet-pipe sprinkler piping.
3. Section 28 46 20, “Fire Alarm.” for connections to alarm devices.

1.3 DEFINITIONS

A. Standard-Pressure Standpipe Piping: Fire-suppression standpipe piping designed to operate at working pressure 175 psig maximum.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For fire-suppression standpipes.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Fire-suppression standpipes, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Domestic water piping.
2. HVAC hydronic piping.
3. Other building services.
4. Refer to Section 21 00 50, “Common Work Results for Fire Suppression Systems,” for additional requirements.

B. Qualification Data: For Installer.

C. Office of the State Fire Marshall (OSFM) certification cards for automatic fire extinguishing systems sprinkler pipefitters.

D. Approved Standpipe Drawings: Working plans, prepared according to NFPA 14, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

E. Welding certificates.

F. Fire-hydrant flow test report.

G. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 14. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."

H. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-suppression standpipes specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing fire-suppression standpipes and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

B. Fire Sprinkler Fitter Certification:

1. Automatic fire extinguishing systems sprinkler pipefitters shall be certified by Office of the State Fire Marshall (OSFM).

C. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. NFPA Standards: Fire-suppression standpipe equipment, specialties, accessories, installation, and testing shall comply with NFPA 14.

1.8 PROJECT CONDITIONS

A. Interruption of Existing Fire-Suppression Standpipe Service: Do not interrupt fire-suppression standpipe service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary fire-suppression standpipe service according to requirements indicated:

1. Notify Owner and Construction Manager no fewer than two days in advance of proposed interruption of fire-suppression standpipe service.
2. Do not proceed with interruption of fire-suppression standpipe service without Owner’s and Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTIONS

A. Manual Wet-Type, Class I Standpipe System: Includes NPS 2-1/2 hose connections. Has small water supply to maintain water in standpipes. Piping is wet, but water must be pumped into standpipes to satisfy demand.

2.2 PERFORMANCE REQUIREMENTS

A. Standard-Pressure, Fire-Suppression Standpipe System Component: Listed for 175-psig minimum working pressure.

B. Fire-suppression standpipe design shall be approved by authorities having jurisdiction.

1. Minimum residual pressure at each hose-connection outlet is as follows:
   a. NPS 2-1/2 Hose Connections: 100 psig.

C. Seismic Performance: Fire-suppression standpipes shall withstand the effects of earthquake motions determined according to NFPA 13, and ASCE/SEI 7.

2.3 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials and for joining methods for specific services, service locations, and pipe sizes.

2.4 BLACK STEEL PIPE AND ASSOCIATED FITTINGS

A. Schedule 40: ASTM A 53/A 53M, Type E, Grade B; with factory- or field-formed ends to accommodate joining method.

B. Schedule 40: ASTM A 795/A 795M, Type E, Grade A; with factory- or field-formed ends to accommodate joining method.

C. Uncoated, Steel Couplings: ASTM A 865/A 865M, threaded.

D. Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

E. Malleable- or Ductile-Iron Unions: UL 860.

F. Cast-Iron Flanges: ASME B16.1, Class 125.

G. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

H. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.

I. Grooved-Joint, Steel-Pipe Appurtenances:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Anvil International.
    b. Shurjoint Piping Products USA Inc.
    c. Smith-Cooper International.
    d. Tyco Fire Products LP.
    e. Victaulic Company.

2. Pressure Rating: 175 psig minimum.
3. Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.5 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free.

1. Class 125, Cast-Iron Flanges and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.6 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or FM Global's "Approval Guide."
2. Pressure Rating:
    a. Standard-Pressure Piping Specialty Valves: 175 psig minimum.
3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

B. Alarm Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
    a. Globe Fire Sprinkler Corporation.
    b. Reliable Automatic Sprinkler Co., Inc. (The).
    c. Tyco Fire Products LP.
    d. Victaulic Company.
    e. Viking Corporation.
2. Standard: UL 193.
3. Design: For horizontal or vertical installation.
4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, and fill-line attachment with strainer.

C. Automatic (Ball Drip) Drain Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
    a. Kidde Fire Fighting; A UTC Business Unit.
    b. Reliable Automatic Sprinkler Co., Inc. (The).
    c. Tyco Fire Products LP.
2. Standard: UL 1726.
3. Pressure Rating: 175 psig minimum.
4. Type: Automatic draining, ball check.
5. Size: NPS 3/4.
6. End Connections: Threaded.

2.7 HOSE CONNECTIONS

A. Nonadjustable-Valve Hose Connections:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
    a. Elkhart Brass Mfg. Co., Inc.

b. Kidde Fire Fighting; A UTC Business Unit.
c. Potter Roemer LLC.
d. Tyco Fire Products LP.
e. Viking Corporation.

2. Standard: UL 668 hose valve for connecting fire hose.
3. Pressure Rating: 300 psig minimum.
4. Material: Brass or bronze.
5. Size: NPS 1-1/2 or NPS 2-1/2, as indicated.
6. Inlet: Female pipe threads.
7. Outlet: Male hose threads with lugged cap, gasket, and chain. Include hose valve threads according to NFPA 1963 and matching local fire-department threads.
8. Pattern: Angle or gate.
9. Finish: Rough brass or bronze.

2.8 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Electrically Operated Alarm Bell:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Fire-Lite Alarms, Inc.; a Honeywell International company.
b. Notifier.
c. Potter Electric Signal Company, LLC.

2. Standard: UL 464.
3. Type: Vibrating, metal alarm bell.
4. Size: 8-inch minimum diameter.
5. Finish: Red-enamel factory finish, suitable for outdoor use.

C. Water-Flow Indicators:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. ADT Security Services, Inc.
b. McDonnell & Miller.
c. Potter Electric Signal Company, LLC.
d. System Sensor.
e. Viking Corporation.
f. Watts; a Watts Water Technologies company.

2. Standard: UL 346.
3. Water-Flow Detector: Electrically supervised.
4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
5. Type: Paddle operated.

6. Pressure Rating: 250 psig.
7. Design Installation: Horizontal or vertical.

D. Pressure Switches:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Barksdale, Inc.
    b. Detroit Switch, Inc.
    c. Kidde Fire Fighting; A UTC Business Unit.
    d. Potter Electric Signal Company, LLC.
    e. System Sensor.
    f. Tyco Fire Products LP.
    g. United Electric Controls Co.
    h. Viking Corporation.

2. Standard: UL 346.
3. Type: Electrically supervised water-flow switch with retard feature.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design Operation: Rising pressure signals water flow.

E. Valve Supervisory Switches:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Fire-Lite Alarms, Inc.; a Honeywell International company.
    b. Kennedy Valve Company; a division of McWane, Inc.
    c. Potter Electric Signal Company, LLC.
    d. System Sensor.

2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.

F. Indicator-Post Supervisory Switches:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Potter Electric Signal Company, LLC.
    b. System Sensor.

2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled indicator-post valve is in other than fully open position.

2.9 MANUAL CONTROL STATIONS

A. Description: UL listed or FM Global approved, hydraulic operation, with union, NPS 1/2 pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.

2.10 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. AMETEK, Inc.
2. Ashcroft Inc.
3. Brecco Corporation.
4. WIKA Instrument Corporation.

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch diameter.

D. Pressure Gage Range: Zero to 250 psig minimum.

E. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 14 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.2 EXAMINATION

A. Examine roughing-in for hose connections and stations to verify actual locations of piping connections before installation.

B. Examine walls and partitions for suitable thickness, fire- and smoke-rated construction, framing for hose-station cabinets, and other conditions where hose connections and stations are to be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 SERVICE-ENTRANCE PIPING

A. Connect fire-suppression standpipe piping to water-service piping at service entrance into building. Comply with requirements for exterior piping in Section 33 10 00 "Site Water Utilities."

B. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

3.4 WATER-SUPPLY CONNECTIONS

A. Connect fire-suppression standpipe piping to building's interior water-distribution piping. Comply with requirements for interior piping in Section 211313 "Wet-Pipe Sprinkler Systems."

B. Install shutoff valve, pressure gage, drain, and other accessories at connection to water-distribution piping. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

3.5 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

B. Piping Standard: Comply with requirements in NFPA 14 for installation of fire-suppression standpipe piping.

C. Install seismic restraints on piping. Comply with requirements in NFPA 13 for seismic-restraint device materials and installation.

D. Install listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install drain valves on standpipes. Extend drain piping to outside of building.

F. Install automatic (ball drip) drain valves to drain piping between fire-department connections and check valves. Drain to floor drain or outside building.

G. Install alarm devices in piping systems.

H. Install hangers and supports for standpipe system piping according to NFPA 14. Comply with requirements in NFPA 13 for hanger materials.

I. Install pressure gages on riser or feed main and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they are not subject to freezing.

J. Fill wet-type standpipe system piping with water.

K. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

L. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

M. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

3.6 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes, and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

I. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

J. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to "Quality Assurance" Article.

1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

K. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

L. Copper-Tubing Grooved Joints: Roll rounded-edge groove in end of tube according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

M. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.7 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 14 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
2. Alarm Valves: Install bypass check valve and retarding chamber drain-line connection.

3.8 HOSE-CONNECTION INSTALLATION

A. Install hose connections adjacent to standpipes.

B. Install freestanding hose connections for access and minimum passage restriction.

C. Install NPS 2-1/2 hose connections with quick-disconnect

3.9 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 14.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260500 "Common Work Results for Electrical."

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Start and run air compressors.
6. Coordinate with fire-alarm tests. Operate as required.
7. Verify that equipment hose threads are same as local fire-department equipment.

C. Fire-suppression standpipe system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.11 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.12 PIPING SCHEDULE

A. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends; cast-iron threaded fittings; and threaded or grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

B. Standard-pressure, wet-type fire-suppression standpipe piping, NPS 6 and smaller, shall be the following:

1. Schedule 40 black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.

END OF SECTION 211200

SECTION 21 13 13 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Specialty valves.
3. Sprinklers.
4. Alarm devices.
5. Pressure gages.

B. Related Requirements:

1. Section 21 05 23 "General-Duty Valves for Water-Based Fire-Suppression Piping" for ball, butterfly, check, gate, post-indicator, and trim and drain valves.

1.3 DEFINITIONS

A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For wet-pipe sprinkler systems.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

C. Product Data for California Green Building Standards Code Compliance: For adhesives and sealants, including primers, documentation of compliance including printed statement of VOC content and chemical components.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Refer to Section 21 00 50, “Common Work Results for Fire Suppression Systems,” for additional requirements.
2. Provide minimum 1/4 inch equals one foot scaled coordination drawings showing plan and pertinent section or elevation views of fire protection piping, equipment, and accessories. Drawings shall be reproducible and work represented shall be fully coordinated with structure, other disciplines, and with finishes. Drawings shall be presented on a single size sheet. Coordination drawings shall have title block, key plan, north arrow and sufficient grid lines to provide cross-reference to DSA approved Drawings.
3. Coordination drawings shall depict changes and additions to fire protection system required for coordination with work of other trades. Changes and additions shall be clouded.
4. Note on coordination drawings piping which will project beyond finished surfaces of normally occupied rooms, exterior of building or other locations which will expose system to view.
5. Coordination drawings shall be provided with note affirming that the fire sprinkler system shown has been coordinated with the HVAC Contractor for inclusion in Coordinated Layout specified in Section 23 31 13, “Metal Ducts.” Provide signature of person responsible for information supplied and date of transmission.

B. For proposed changes to supports, anchorage, and seismic restraints shown on DSA approved Contract Drawings, submit details and calculations prepared, sealed, and signed by a California registered structural engineer. Comply with requirements of Section 22 00 50, “Common Work Results for Fire Suppression Systems.

C. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

D. Qualification Data: For qualified Installer and professional engineer.

E. Office of the State Fire Marshall (OSFM) certification cards for automatic fire extinguishing systems sprinkler pipefitters.

F. Welding certificates.

G. Field Test Reports:

1. Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
2. Fire-hydrant flow test report.

H. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.8 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of fire protection products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer Qualifications:

1. A firm with at least five years of successful installation experience on projects with fire sprinkler piping systems similar to that required for this Project.

a. A State of California Fire Protection Contractor’s license (C-16) is required.

C. Fire Sprinkler Fitter Certification:

1. Automatic fire extinguishing systems sprinkler pipefitters shall be certified by Office of the State Fire Marshall (OSFM).

D. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

1.9 FIELD CONDITIONS

A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:

1. Notify Owner and Construction Manager no fewer than two days in advance of proposed interruption of sprinkler service.
2. Do not proceed with interruption of sprinkler service without Owner and Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13.

B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

C. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13, CBC, and ASCE/SEI 7.

2.2 STEEL PIPE AND FITTINGS

A. Schedule 40, Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method. Corrosion Resistance Ratio (CRR) Shall be 1.0 or greater.

B. Schedule 10, Black-Steel Pipe: ASTM A 135/A 135M or ASTM A 795/A 795M, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10, plain end.

C. Malleable- or Ductile-Iron Unions: UL 860.

D. Cast-Iron Flanges: ASME 16.1, Class 125.

E. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.

1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

F. Grooved-Joint, Steel-Pipe Appurtenances:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Anvil International.
    b. Corcoran Piping System Co.
    c. National Fittings, Inc.
    d. Shurjoint Piping Products USA Inc..
    e. Smith-Cooper International.
    f. Tyco Fire Products LP.
    g. Victaulic Company.

2. Pressure Rating: 175-psig minimum.
3. Galvanized Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.
4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.3 SPECIALTY VALVES

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Pressure Rating:

1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.

C. Body Material: Cast or ductile iron.

D. Size: Same as connected piping.

E. End Connections: Flanged or grooved.

F. Alarm Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Globe Fire Sprinkler Corporation.
   b. Reliable Automatic Sprinkler Co., Inc. (The).
   c. Tyco Fire Products LP.
   d. Venus Fire Protection Ltd.
   e. Victaulic Company.
   f. Viking Corporation.

2. Standard: UL 193.
3. Design: For horizontal or vertical installation.
4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, and fill-line attachment with strainer.
5. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
6. Drip Cup Assembly: Pipe drain with check valve to main drain piping.
7. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.4 SPRINKLER PIPING SPECIALTIES

A. Branch Outlet Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Anvil International.
   b. National Fittings, Inc.
   c. Shurjoint Piping Products USA Inc.
   d. Tyco Fire Products LP.
   e. Victaulic Company.

2. Standard: UL 213.
3. Pressure Rating: 175-psig minimum.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-tee and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Flow Detection and Test Assemblies:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. AGF Manufacturing Inc.
    b. Reliable Automatic Sprinkler Co., Inc. (The).
    c. Tyco Fire Products LP.
    d. Victaulic Company.

2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig minimum.
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded or grooved.

C. Sprinkler Inspector's Test Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. AGF Manufacturing Inc.
    b. Triple R Specialty.
    c. Tyco Fire & Building Products LP.
    d. Victaulic Company.
    e. Viking Corporation.

2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

2.5 SPRINKLERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Globe Fire Sprinkler Corporation.
2. Tyco Fire Products LP.
3. Viking Corporation.

B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

C. Pressure Rating for Automatic Sprinklers: 175-psig minimum.

D. Automatic Sprinklers with Heat-Responsive Element:

1. Nonresidential Applications: UL 199.
2. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

E. Sprinkler Finishes: Chrome plated and bronze.

F. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Steel, white finish, one piece, flat.
2. Sidewall Mounting: Steel, white finish, one piece, flat.

G. Sprinkler Guards:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Tyco Fire Products LP.
   b. Viking Corporation.

2. Standard: UL 199.
3. Type: Wire cage with fastening device for attaching to sprinkler.

2.6 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Electrically Operated Alarm Bell:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Fire-Lite Alarms, Inc.; a Honeywell International company.
   b. Notifier.
   c. Potter Electric Signal Company, LLC.

2. Standard: UL 464.
3. Type: Vibrating, metal alarm bell.
4. Size: 8-inch minimum diameter.
5. Finish: Red-enamel factory finish, suitable for outdoor use.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Water-Flow Indicators:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. ADT Security Services, Inc.
   b. McDonnell & Miller.
   c. Potter Electric Signal Company, LLC.
   d. System Sensor.
   e. Viking Corporation.
   f. Watts; a Watts Water Technologies company.

2. Standard: UL 346.
3. Water-Flow Detector: Electrically supervised.

4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
5. Type: Paddle operated.
6. Pressure Rating: 250 psig.
7. Design Installation: Horizontal or vertical.

D. Pressure Switches:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Tyco Fire Products LP.
   b. Viking Corporation.

2. Standard: UL 346.
3. Type: Electrically supervised water-flow switch with retard feature.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design Operation: Rising pressure signals water flow.

E. Valve Supervisory Switches:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
   a. Fire-Lite Alarms, Inc.; a Honeywell International company.
   b. Kennedy Valve Company; a division of McWane, Inc.
   c. Potter Electric Signal Company, LLC.

2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.7 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. AMETEK, Inc.
2. Ashcroft Inc.
3. WIKA Instrument Corporation.

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch diameter.

D. Pressure Gage Range: 0- to 250-psig minimum.

E. Label: Include "WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.2 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install alarm devices in piping systems.

K. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13. In seismic-rated areas, refer to Section 21 05 48 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."

L. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they are not subject to freezing.

M. Fill sprinkler system piping with water.

N. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 21 05 17 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

O. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 21 05 18 "Escutcheons for Fire-Suppression Piping."

3.3 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

G. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

H. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

3.4 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. Install valves in vertical position for proper direction of flow, in main supply to system.
2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.

3.5 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.

B. Provide return bend as illustrated in NFPA 13 (NFPA exceptions do not apply) for each sprinkler head installed in finished ceiling.

3.6 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 00 "Common Work Results for Electrical."

3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Coordinate with fire-alarm tests. Operate as required.
6. Verify that equipment hose threads are same as local fire department equipment.

B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.8 CLEANING

A. Clean dirt and debris from sprinklers.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.9 DEMONSTRATION AND TRAINING

A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves. Provide minimum one hour of training.

3.10 PIPING SCHEDULE

A. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be the following:

1. Schedule 40, black-steel or galvanized pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.

B. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 and larger, shall be the following:
1. Schedule 10, black-steel pipe with grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3.11 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Upright sprinklers.
2. Rooms with Suspended Ceilings: Pendent, recessed, flush, and concealed sprinklers as indicated.

a. Ceilings at 9 feet 0 inches or lower: Recessed or concealed.
b. Ceiling at 8 feet 0 inches or lower: Concealed.
c. Ceilings in unsupervised areas such as corridors, arcades, and restrooms with a ceiling height of 9 feet 0 inches or lower: Concealed.

3. Wall Mounting: Sidewall sprinklers.

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
2. Flush Sprinklers: Bright chrome, with painted white escutcheon.
3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
4. Residential Sprinklers: Dull chrome.
5. Upright, Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

C. Provide sprinkler guards on sprinkler heads installed at 7 feet 6 inches above finished floor or lower in exposed locations or those that are deemed subject to damage. Sprinkler guard shall be securely fastened with a bolt-on feature to the base of the sprinkler or be a factory-installed guard. Guards shall also be provided on upright and sidewall heads where sprinklers are installed at 7 feet 6 inches above finished floor or lower.

D. Sprinkler heads installed in suspended ceiling shall comply with DSA IR 25 2.13 and 3.13.

END OF SECTION 211313

This page intentionally left blank.

SECTION 22 00 50 - COMMON WORK RESULTS FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. General requirements applicable to all Division 22 Sections.

1.2 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. This Section is a part of each Division 22 Section.

C. Section 23 11 23, Facility Natural Gas Piping: Requirements for natural gas piping system.

1.3 ADDITIONAL REQUIREMENTS

A. Furnish and install any incidental work not shown or specified which is necessary to provide a complete and workable system.

B. Make all temporary connections required to maintain services during the course of this Contract without additional cost to the Owner. Notify the Owner seven days in advance before disturbing services.

C. All plumbing work required by Contract Documents shall be performed in strict accordance with all codes and regulations. Plumbing work done under this Contract shall not adversely affect the operation of the existing plumbing systems.

1.4 REFERENCES AND STANDARDS

A. Where material or equipment is specified to conform to referenced standards, it shall be assumed that the most recent edition of the standard in effect at the time of bid shall be used.

1. CSA – Canadian Standards Association International.
2. ANSI - American National Standards Institute.
3. ASTM - American Society for Testing and Materials.
4. CCR - California Code of Regulations.

    a. Title 8 - Division of Industrial Safety, Subchapter 7; General Industry Safety Orders, Articles 31 through 36.

5. NCPWB - National Certified Pipe Welding Bureau.
6. CEC - California Electrical Code.
7. NEMA - National Electrical Manufacturers' Association.
8. NFPA - National Fire Protection Association.
9. OSHA - Occupational Safety and Health Act.
10. UL - Underwriters' Laboratories, Inc.

B. Requirements of Regulatory Agencies:

1. The publications listed below form part of this specification; comply with provisions of these publications except as otherwise shown or specified.

2. Code editions shall be as noted on Drawings, as adopted by the California Division of the State Architect (DSA).

   a. California Building Code.
   b. California Electrical Code.
   c. California Energy Code.
   d. California Fire Code.
   e. California Green Building Standards Code.
   f. California Mechanical Code.]
   g. California Plumbing Code.]
   h. California Code of Regulations, Title 24.
   i. California Health and Safety Code.
   j. CAL-OSHA.
   k. California State Fire Marshal, Title 19 CCR.
   l. National Fire Protection Association.
   m. Occupational Safety and Health Administration.
   n. Other applicable state laws.

3. Nothing in Drawings or specifications shall be construed to permit work not conforming to these codes, or to requirements of authorities having jurisdiction. It is not the intent of Drawings or specifications to repeat requirements of codes except where necessary for clarity.

1.5 DRAWINGS

A. Examine Contract Documents prior to bidding of work and report discrepancies in writing to Architect.

B. Drawings showing location of equipment and materials are diagrammatic and job conditions will not always permit installation in location shown. The Plumbing Drawings show general arrangement of equipment and materials, etc., and shall be followed as closely as existing conditions, actual building construction, and work of other trades permit.

1. Architectural and Structural Drawings shall be considered part of the Work. These Drawings furnish Contractor with information relating to design and construction of the Project. Architectural Drawings take precedence over Plumbing Drawings.
2. Because of the small scale of Plumbing Drawings, not all offsets, fittings, and accessories required are shown. Investigate structural and finish conditions affecting the Work and arrange Work accordingly. Provide offsets, fittings, and accessories required to meet conditions. Inform Architect immediately when job conditions do not permit installation of equipment and materials in the locations shown. Obtain the Architects approval prior to relocation of equipment and materials.
3. Relocate equipment and materials installed without prior approval of the Architect. Remove and relocate equipment and materials at Contactors' expense upon Architects' direction.
4. Minor changes in locations of equipment, piping, etc., from locations shown shall be made when directed by the Architect at no additional cost to the Owner providing such change is ordered before such items of work, or work directly connected to same are installed and providing no additional material is required.

C. Execute work mentioned in Specifications and not shown on Drawings, or vice versa, the same as if specifically mentioned or shown in both.

1.6 FEES AND PERMITS

A. Obtain and pay for all permits and service required in installation of this work; arrange for required inspections and secure approvals from authorities having jurisdiction. Comply with requirements of Division 01.

B. Arrange for utility connections and pay charges incurred, including excess service charges.

1. Contractor shall bear the cost of construction related to utility services, from point of connection to utility services shown on Contract Documents. This includes piping, excavation, backfill, meters, boxes, check valves, backflow prevention devices, general service valves, concrete work, and the like, whether or not Work is performed by Contractor, local water/sanitation district, public utility, other governmental agencies or agencies' assigns.

1.7 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Submittals shall be submitted in accordance with the requirements of Section 01 33 00, Submittal Procedures.

2. Closeout Submittals shall be submitted in accordance with the requirements of Section 01 7700, Closeout Procedures.

B. Coordination:

1. General:

a. Coordinate plumbing Work with trades covered in other Specifications Sections to provide a complete, operable and sanitary installation of the highest quality workmanship.

2. Electrical Coordination:

a. Refer to Section 26 05 30, "Conduit and Wire," for service voltage and power feed wiring for equipment specified under this section. Contractor has full responsibility for the following items of work:

1) Review the Electrical Drawings and Division 26 Specifications to verify that electrical services provided are adequate and compatible with equipment requirements.
2) If additional electrical services are required above that indicated on Electrical Drawings and in Division 26, such as more control interlock conductors, larger feeder, or separate 120 volt control power source, include cost to furnish and install additional electrical services as part of the bid.
3) Prior to proceeding with installation of additional electrical work, submit detailed drawings indicating exact scope of additional electrical work.

3. Mechanical Coordination:

a. Arrange for pipe spaces, chases, slots and openings in building structure during progress of construction, to accommodate mechanical system installation.

b. Coordinate installation of supporting devices. Set sleeves in poured-in-place concrete and other structural components during progress of construction.
c. Coordinate requirements for access panels and doors for mechanical items requiring access where concealed behind finished surfaces.
d. Coordinate with other trades equipment locations, pipe, duct and conduit runs, electrical outlets and fixtures, air inlets and outlets, and structural and architectural features. Provide information on location of piping and seismic bracing to other trades as required for a completely coordinated project.

1.8 SUBMITTALS - GENERAL

A. Submittal packages may be submitted via email as PDF electronic files, or as printed packages. PDFs shall be legible at actual size (100 percent). Provide seven copies of printed submittal packages.

B. Provide submittal of materials proposed for use as part of this Project. Product names in Specifications and on Drawings are used as standards of quality. Furnish standard items on specified equipment at no extra cost to the Contract regardless of disposition of submittal data. Other materials or methods shall not be used unless approved in writing by Architect. Architect's review will be required even though "or equal" or synonymous terms are used. Refer to Division 01 for complete instructions.

1. Partial or incomplete submittals will not be considered.
2. Quantities are Contractor's responsibility and will not be reviewed.
3. Provide materials of the same brand or manufacturer for each class of equipment or material.
4. Identify each item by manufacturer, brand, trade name, number, size, rating, or other data necessary to properly identify and review materials and equipment. Words "as specified" are not sufficient identification.
5. Identify each submittal item by reference to items' Specification Section number and paragraph, by Drawing and detail number, and by unit tag number.
6. Organize submittals in same sequence as in Specification Sections.
7. Show physical arrangement, construction details, finishes, materials used in fabrications, provisions for piping entrance, access requirements for installation and maintenance, physical size, mechanical characteristics, foundation and support details, and weight.

a. Submit Shop Drawings, performance curves, and other pertinent data, showing size and capacity of proposed materials.
b. Specifically indicate, by drawn detail or note, that equipment complies with each specifically stated requirement of Contract Documents.
c. Drawings shall be drawn to scale and dimensioned (except schematic diagrams). Drawings may be prepared by vendor but must be submitted as instruments of Contractor, thoroughly checked and signed by Contractor before submission to Architect for review.
d. Catalog cuts and published material may be included with supplemental scaled drawings.

C. Review of submittals will be only for general conformance with design concept and general compliance with information given in Contract Documents. Review will not include quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with work of other trades, or construction safety precautions, which are sole responsibility of Contractor. Review of a component of an assembly does not indicate acceptance of an assembly. Deviations from Contract Documents not clearly identified by Contractor are Contractor's responsibility and will not be reviewed by Architect.

D. Within reasonable time after award of contract and in ample time to avoid delay of construction, submit to Architect Shop Drawings or submittals on all items of equipment and materials provided. Provide submittal in at least seven copies and in complete package.

1. Shop Drawings and submittals shall include Specification Section, Paragraph number, and Drawing unit symbol or detail number for reference. Organize submittals into booklets for each Specification section and submit in loose-leaf binders with index. Deviations from the Contract Documents shall be prominently displayed in the front of the submittal package and referenced to the applicable Contract requirement.

E. Furnish to the Project Inspector complete installation instructions on material and equipment before starting installation.

1.9 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for plumbing systems materials and products.

B. Shop Drawings.

C. Provide product data for insulation products, including insulation, insulation facings, jackets, adhesives, sealants, and coatings, indicating compliance with requirement that these products contain less than 0.1 percent (by mass) polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations.

D. Sustainable Design Submittals:

1. Product Data: For adhesives and sealants, documentation of compliance including printed statement of VOC content and chemical components.

E. Pipe, pipe or plumbing fittings, fixtures, solder and flux installed in a system providing water for human consumption shall comply with lead free requirements of the California Health and Safety Code Section 116875. Provide submittal information for products third-party certified by an approved laboratory as complying with California Health and Safety Code Section 116875.

1.10 INFORMATIONAL SUBMITTALS

A. Provide layouts for plumbing systems, for inclusion in coordinated layout specified in Section 23 31 13, “Metal Ducts.” Comply with requirements for layouts specified in Section 23 31 13.

B. Equipment training session agenda.

1.11 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Refer to Section 01 78 23, Operation and Maintenance Data, for complete instructions. Requirements given below are in addition to or are intended to amplify Division 01 requirements. In case of conflict between requirements given in this Section and those of Division 01, Division 01 requirements shall apply.
2. Furnish three complete sets of Operation and Maintenance Manual bound in hardboard binder, and one compact disc containing complete Operation and Maintenance Manual in searchable PDF format. Provide Table of Contents. Provide index tabs for each piece of equipment in binder and disc. Begin compiling data upon approval of submittals.

a. Sets shall incorporate the following:

1) Product Data.
2) Shop Drawings.
3) Record Drawings.
4) Service telephone number, address and contact person for each category of equipment or system.
5) Complete operating and maintenance instructions for each item of plumbing equipment and systems.
6) Copies of guarantees/warrantees for each item of equipment and systems.
7) Test data and system balancing reports.
8) Typewritten maintenance instructions for each item of equipment listing lubricants to be used, frequency of lubrication, inspections required, adjustment, etc.
9) Manufacturers' bulletins with parts numbers, instructions, etc., for each item of equipment.
10) Control diagrams and literature.
11) [A complete list or schedule of all scheduled valves giving the number of the valve, location and the rooms or area controlled by the valve. Identify each valve with a permanently attached metal tag stamped with number to match schedule. Post list in frame under plastic on wall in mechanical room or where directed by Architect.]
12) Check test and start reports for each piece of plumbing equipment provided as part of the Work.
13) Commissioning and Preliminary Operation Tests required as part of the Work.

b. Post service telephone numbers and/or addresses in an appropriate place as designated by the Architect.

B. Record Drawings:

1. Refer to Section 01 78 39, Project Record Documents, for requirements governing Work specified herein.
2. Upon completion of the work, deliver to Architect the following:

a. Originals of drawings showing the Work exactly as installed.
b. One complete set of reproducible drawings showing the Work exactly as installed.
c. One compact disc with complete set of drawings in PDF format showing the Work exactly as installed.
d. Provide Contractor’s signature, verifying accuracy of record drawings.

3. Obtain the signature of the Project Inspector of Record for record drawings.

1.12 SUBSTITUTIONS

A. Refer to Section 01 25 00, Substitution Procedures, for complete instructions. Requirements given below are in addition to or are intended to amplify Division 01 requirements. In case of conflict between requirements given in this Section and those of Division 01, Division 01 requirements shall apply.

B. It is the responsibility of Contractor to assume costs incurred because of additional work and or changes required to incorporate proposed substitute into the Project. Refer to Division 01 for complete instructions.

C. Substitutions will be interpreted to be all manufacturers other than those specifically listed in the Contract Documents by brand name, model or catalog number.

D. Only one request for substitution will be considered for each item of equipment or material.

E. Substitution requests shall include the following:

1. Reason for substitution request.
2. Complete submittal information as described herein; see “Submittals.”
3. Coordinated scale layout drawings depicting position of substituted equipment in relation to other work, with required clearances for operation, maintenance and replacement.
4. List optional features required for substituted equipment to meet functional requirements of the system as indicated in Contract Documents.
5. Explanation of impact on connected utilities.
6. Explanation of impact on structural supports.

F. Installation of reviewed substitution is the Contractors’ responsibility. Any mechanical, electrical, structural, or other changes required for installation of reviewed substituted equipment or material must be made by the Contractor without additional cost to the Owner. Review by the Architect of the substituted equipment or material, including dimensioned Drawings will not waive these requirements.

G. Contractor may be required to compensate the Architect for costs related to substituted equipment or material.

1.13 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing systems products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Contractor's Qualifications: Firm with at least 5 years of successful installation experience on projects with plumbing systems work similar to that required for this Project.

C. Comply with applicable portions of California Plumbing Code pertaining to selection and installation of plumbing materials and products.

D. All materials and products shall be new and shall match existing.

1.14 DELIVERY, STORAGE, AND HANDLING

A. Protect equipment and piping delivered to Project site from weather, humidity and temperature variations, dirt, dust and other contaminants.

1.15 FIELD CONDITIONS

A. Contractor shall visit Project site and examine existing conditions in order to become familiar with Project scope. Verify dimensions shown on Drawings at Project site. Bring discrepancies to the attention of Architect. Failure to examine Project site shall not constitute basis for claims for additional work because of lack of knowledge or location of hidden conditions that affect Project scope.

B. Information on Drawings relative to existing conditions is approximate. Deviations from Drawings necessary during progress of construction to conform to actual conditions shall be approved by the Architect and shall be made without additional cost to the Owner. The Contractor shall be held responsible for damage caused to existing services. Promptly notify the Architect if services are found which are not shown on Drawings.

1.16 WARRANTY

A. Refer to Division 01 Specifications for warranty requirements, including effective date of warranty. Refer to specific items of equipment specified herein for warranty duration if different from that specified in Division 01.

B. Repair or replace defective work, material, or part that appears within the warranty period, including damage caused by leaks.

C. On failure to comply with the above warranty within a reasonable length of time after notification is given, the Architect/Owner shall have the repairs made at the Contractor's expense.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials or equipment of the same type shall be of the same brand wherever possible. All materials shall be new and in first class condition.

B. All sizes, capacities, and efficiency ratings shown are minimum, except that gas capacity is maximum available.

C. Refer to Division 22 technical Sections for specific system piping materials.

2.2 MATERIALS

A. No material installed as part of this Work shall contain asbestos.

B. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).

2.3 MOTOR STARTERS

A. Square D, Allen Bradley, or equal, in NEMA Type 1 enclosure, unless otherwise specified or required. Minimum starter size shall be Size 1. Provide NEMA 3R enclosure where exposed to outdoors.

B. Provide magnetic motor starters for equipment provided under the Mechanical Work. Starters shall be non-combination type. Provide part winding or reduced voltage start motors where shown or as hereinafter specified. Minimum size starter shall be Size 1.

1. All starters shall have the following:

   a. Cover mounted hand-off-automatic switch. Starters installed exposed in occupied spaces shall have key operated HOA switch.
   b. Ambient compensated thermal overload.
   c. Fused control transformer (for 120 or 24 volt service).
   d. Pilot lights, integral with the starters. Starters located outdoors shall be in NEMA IIIR enclosures.

2. Where three phase motors are provided for two-speed operation, provide two speed motor starters.
3. Starters for single-phase motors shall have thermal overloads. NEMA I enclosure for starters located indoors, NEMA IIIR enclosure for starters located outdoors.

4. Provide OSHA label indicating the device starts automatically.

2.4 VALVE BOXES

A. General:

1. Where several valves or other equipment are grouped together, provide larger boxes of rectangular "vault" type adequately sized for condition and similar in construction to those specified above.
2. Provide valve box extensions as required to set bottom of valve box tight up to top of piping in which valve is installed.
3. Provide a tee handle wrench for each size, Alhambra Foundry Co. #A-3008, or equal.

B. Valve Boxes in Traffic Areas: Provide Christy No. G5 traffic valve box, Brooks, or equal, 10-3/8 inches inside diameter with extensions to suit conditions, with cast iron or steel locking cover. Provide Owner with set of special wrenches or tools as required for operation of valves.

C. Valve Boxes in Non-Traffic Areas: Provide Christy No. F22, Brooks, or equal, 8 inches inside diameter by 30 inches long, with cast iron or steel locking cover. Provide Owner with set of special wrenches or tools as required for operation of valves. Cut bottom of plastic body for operation of valves.

D. Valve Box (Rectangular Vault Type): Precast concrete or cast iron with cast iron or steel locking type covers lettered to suit service – Brooks No. 3-TL, Christy No. B3, Fraser No. 3, Alhambra A-3004 or A-3005, Alhambra E-2202, or E-2702, or equal, with extension to suit conditions.

2.5 ACCESS DOORS

A. Where floors, walls, or ceilings must be penetrated for access to mechanical equipment, provide access doors, 14 inch by 14 inch minimum size in usable opening. Where entrance of a serviceman may be required, provide 20 inch by 30 inch minimum usable opening. Locate access doors/panels for non-obstructed and easy reach.

1. All access doors less than 7'-0" above floors and exposed to public access shall have keyed locks.

B. Access doors shall match those supplied in Division 08 in all respects, except as noted herein.

C. Provide stainless steel access doors for use in toilet rooms, shower rooms, kitchens and other damp areas. Provide steel access doors with prime coat of baked-on paint for all other areas.

D. Do not locate access doors in highly visible public areas such as lobbies, waiting areas, and primary entrance areas. Coordinate with the Architect when access is required in these areas.

E. Where specific information or details relating to access panels different from the above is shown or given on the Drawings or other Divisions of work, then that information shall supersede this specification.

F. Manufacturers: Subject to compliance with requirements, available manufacturers offering products which may be incorporated into the Work include Milcor, Karp, Nystrom, or Cesco, equal to the following:

1. Milcor

a. Style K (plaster).
b. Style DW (gypsum board).
c. Style M (Masonry).
d. Style "Fire Rated" where required.

PART 3 - EXECUTION

3.1 FRAMING, CUTTING AND PATCHING

A. Special framing, recesses, chases and backing for Work of this Section, unless otherwise specified, are covered under other Specification Sections.

B. Contractor is responsible for placement of pipe sleeves, hangers, inserts, supports, and location of openings for the Work.

3.2 ELECTRICAL REQUIREMENTS

A. Provide adequate working space around electrical equipment in compliance with the California Electrical Code. Coordinate the Mechanical Work with the Electrical Work to comply.

B. Furnish necessary control diagrams and instructions for the controls. Before permitting operation of any equipment which is furnished, installed, or modified under this Section, review all associated electrical work, including overload protection devices, and assume complete responsibility for the correctness of the electrical connections and protective devices. Motors and control equipment shall conform to the Standards of the National Electrical Manufacturers' Association. All equipment and connections exposed to the weather shall be NEMA IIIR with factory-wired strip heaters in each starter enclosure and temperature control panel where required to inhibit condensation.

C. All line voltage and low voltage wiring and conduit associated with the Temperature Control System are included in this Section. Wiring and conduit shall comply with Division 26.

3.3 PIPING SYSTEM REQUIREMENTS

A. Drawing plans, schematic and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

3.4 INSTALLATION OF PIPING SYSTEMS

A. At time of final connection, and prior to opening valve to allow pressurization of water and gas piping from existing systems, on site or off site, perform a pressure test to indicate static pressure of existing systems. If pressure on water piping is greater than 80 psi, or gas pressure is not as indicated on Contract Documents, inform Architect immediately. Do not allow piping systems to be pressurized without written consent of the Architect.

B. General:

1. All piping shall be concealed unless shown or otherwise directed. Allow sufficient space for ceiling panel removal.
2. Installation of piping shall be made with appropriate fittings. Bending of piping will not be accepted.
3. Install piping to permit application of insulation and to allow valve servicing.
4. Where piping or conduit is left exposed within a room, the same shall be run true to plumb, horizontal, or intended planes. Where possible, uniform margins are to be maintained between parallel lines and/or adjacent wall, floor, or ceiling surfaces.

5. Horizontal runs of pipes and/or electrical conduit suspended from ceilings shall provide for a maximum headroom clearance. The clearance shall not be less than 6'-6" without written approval from the Architect.
6. Close ends of pipe immediately after installation. Leave closure in place until removal is necessary for completion of installation.
7. Each piping system shall be thoroughly flushed and proved clean before connection to equipment.
8. Pipe the discharge of each relief valve, air vent, backflow preventer, and similar device to floor sink or drain.
9. Install exposed polished or enameled connections with special care showing no tool marks or threads at fittings.
10. Install horizontal valves with valve stem above horizontal.
11. Use reducing fittings; bushings shall not be allowed. Use eccentric reducing fittings wherever necessary to provide free drainage of lines and passage of air.
12. Verify final equipment locations for roughing-in.
13. Sanitary Sewer and Storm Drain: Grade piping inside building uniformly 1/4 inch per foot if possible but not less than 1/8 inch per foot. Run piping as straight as possible. Make piping connections between building piping and outside service pipe with cast iron reducers or increasers. Slope sewers uniformly between given elevations where invert elevations are shown.
14. Where piping is installed in walls within one inch of the face of stud, provide a 16 gauge sheet metal shield plate on the face of the stud. The shield plate shall extend a minimum of 1-1/2 inches beyond the outside diameter of the pipe.

3.5 ACCESS DOORS

A. Furnish and install access doors wherever required whether shown or not for easy maintenance of mechanical systems; for example, at concealed valves, strainers, traps, cleanouts, dampers, motors, controls, operating equipment, etc. Access doors shall provide for complete removal and replacement of equipment.

3.6 EXPANSION ANCHORS IN HARDENED CONCRETE

A. Refer to Structural Drawings.

3.7 OPERATION OF SYSTEMS

A. Do not operate any plumbing equipment for any purpose, temporary or permanent, until all of the following has been completed:

1. Complete all requirements listed under “Check, Test and Start Requirements.”
2. Piping has been properly cleaned. Piping systems shall be flushed and treated prior to operation.
3. Filters, strainers etc. are in place.
4. Bearings have been lubricated, and alignment of rotating equipment has been checked.
5. Equipment has been run under observation, and is operating in a satisfactory manner.

B. Provide test and balance agency with one set of Contract Drawings, Specifications, Addenda, Change orders issued, applicable shop drawings and submittals and temperature control drawings.

3.8 CHECK, TEST AND START REQUIREMENTS

A. An authorized representative of the equipment manufacturer shall perform check, test and start of each piece of plumbing equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the check test and start of the equipment.

1. As part of the submittal process, provide a copy of each manufacturer's printed startup form to be used.
2. Some items of specified equipment may require that check, test and start of equipment must be performed by the manufacturer, using manufacturer's employees. See specific equipment Articles in these Specifications for this requirement.
3. Provide all personnel, test instruments, and equipment to properly perform the check, test and start work.
4. When work has been completed, provide copies of reports for review, prior to final observation of work.

B. Provide copies of the completed check, test and start report of each item of equipment, bound with the Operation and Maintenance Manual.

C. Upon completion of the work, provide a schedule of planned maintenance for each piece of equipment. Indicate frequency of service, recommended spare parts (including filters and lubricants), and methods for adjustment and alignment of all equipment components. Provide a copy of the schedule with each operating and maintenance manual. Provide a copy of certification from the Owner's representative indicating that they have been properly instructed in maintenance requirements for the equipment installed.

3.9 PRELIMINARY OPERATIONAL REQUIREMENTS AND TESTS

A. Prior to observation to determine final acceptance, put all mechanical systems into service and check that work required for that purpose has been done, including but not limited to the following condensed check list. Provide indexed report to tabulating the results of all work.

1. Refer to Division 22 technical Sections for specific testing requirements.
2. All equipment has been started, checked, lubricated and adjusted in accordance with the manufacturer's recommendations.
3. Correct rotation of motors and ratings of overload heaters are verified.
4. Specified filters are installed and spare filters have been turned over to Owner.
5. All manufacturers' certificates of start-up specified have been delivered to the Owner.
6. All equipment has been cleaned, and damaged painted finishes touched up.
7. Missing or damaged parts have been replaced.
8. Flushing and chemical treatment of piping systems has been completed and water treatment equipment, where specified, is in operation.
9. Equipment labels, pipe marker labels, ceiling markers and valve tags are installed.
10. Valve tag schedules, corrected control diagrams, sequence of operation lists and start-stop instructions have been posted.
11. Preliminary test and balance work is complete, and reports have been forwarded for review.
12. Automatic control set points are as designated and performance of controls checks out to agree with the sequence of operation.
13. Operation and Maintenance Manuals have been delivered and instructions to the operating personnel have been made.

B. Prior to the observation to determine final acceptance, operate all mechanical systems as required to demonstrate that the installation and performance of these systems conform to the requirements of these specifications.

1. Operate and test all mechanical equipment and systems for a period of at least five consecutive 8 hour days to demonstrate the satisfactory overall operation of the project as a complete unit.
2. Commence tests after preliminary balancing and adjustments to equipment have been checked. Immediately before starting tests, install air filters and lubricate all running equipment. Notify the Architect at least seven calendar days in advance of starting the above tests.
3. During the test period, make final adjustments and balancing of equipment, systems controls, and circuits so that all are placed in first class operating condition.

C. Review of Contractor's Tests:

1. All tests made by the Contractor or manufacturers' representatives are subject to observation and review by the Owner. Provide timely notice prior to start of each test, in order to allow for observation of testing. Upon the completion of all tests, provide report to confirm that all testing has been successful.

D. Test Logs:

1. Maintain test logs listing the tests on all mechanical systems showing dates, items tested, inspectors' names, remarks on success or failure of the tests.

E. Preliminary Operation:

1. The Owner reserves the right to operate portions of the plumbing system on a preliminary basis without voiding the guarantee.

3.10 CERTIFICATES OF INSTALLATION

A. Contractor shall complete applicable “Certificates of Installation” forms contained in the California Building Energy Efficiency Standards and submit to the authorities having jurisdiction for approval and issuance of final occupancy permit, as described in the California Energy Code.

3.11 DEMONSTRATION AND TRAINING

A. An authorized representative of the equipment manufacturer shall train Owner-designated personnel in maintenance and adjustment of equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the Owner training for the equipment installed.

1. As part of the submittal process, provide a training agenda outlining major topics and time allowed for each topic.
2. Some items of specified equipment require that training must be performed by the manufacturer, using manufacturer’s employees. See specific equipment Articles in these Specifications for this requirement.
3. Contractor shall provide three copies of certification by Contractor that training has been completed, signed by Owner’s representative, for inclusion in Operation and Maintenance Manual. Certificates shall include:

    a. Listing of Owner-designated personnel completing training, by name and title.
    b. Name and title of training instructor.
    c. Date(s) of training.
    d. List of topics covered in training sessions.

4. Refer to specific equipment Sections for minimum training period duration for each piece of equipment.

3.12 COMMISSIONING

A. This Project will be commissioned by a third-party Commissioning Agent. In addition to the requirements of Division 22 Specifications, comply with the requirements of Section 01 91 13, “General Commissioning Requirements.”

END OF SECTION 22 00 50

This page intentionally left blank.

SECTION 220513 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.
2. Energy and Premium-Efficient Motors – Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
5. Each motor shall be provided with a shaft grounding device for stray current protection.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 220513

This page intentionally left blank.

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.
4. Silicone sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For sealants, indicating VOC content.
2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. GPT; an EnPro Industries company.

B. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized zinc coated, with plain ends.

C. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. GPT; an EnPro Industries company.
4. Metraflex Company (The).
5. Proco Products, Inc.

B. Description:

1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel.
4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B 633 of length required to secure pressure plates to sealing elements.

2.3 GROUT

A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200, “Joint Sealants.”

E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

a. Piping Smaller Than NPS 6: Steel pipe sleeves.
b. Piping NPS 6 and Larger: Steel pipe sleeves.

2. Exterior Concrete Walls below Grade:

a. Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Steel pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

a. Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Steel pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Interior Partitions:

a. Piping Smaller Than NPS 6: Steel pipe sleeves.
b. Piping NPS 6 and Larger: Galvanized-steel sheet sleeves.

END OF SECTION 220517

SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.3 DEFINITIONS

A. Existing Piping to Remain: Existing piping that is not to be removed and that is not otherwise indicated to be removed and salvaged, or removed and reinstalled.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. BrassCraft Manufacturing Co.; a Masco company.
2. Dearborn Brass.

2.2 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished, chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.

2.3 FLOOR PLATES

A. Split Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
b. Insulated Piping: One-piece stamped steel with polished, chrome-plated finish.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece cast brass with polished, chrome-plated finish.
d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece cast brass with polished, chrome-plated finish.
e. Bare Piping in Unfinished Service Spaces: One-piece stamped steel with polished, chrome-plated finish.
f. Bare Piping in Equipment Rooms: One-piece stamped steel with polished, chrome-plated finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor plate. Cast-iron flange with holes for fasteners.

3.2 FIELD QUALITY CONTROL

A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION 220518

SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bimetallic-actuated thermometers.
2. Thermowells.
3. Dial-type pressure gages.
4. Gage attachments.
5. Test plugs.
6. Test-plug kits.
7. Sight flow indicators.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter and gage.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Ashcroft Inc.
2. Marsh Bellofram.
3. Miljoco Corporation.

4. Palmer Wahl Instrumentation Group.
5. REOTEMP Instrument Corporation.
6. Trerice, H. O. Co.
7. Weiss Instruments, Inc.

B. Standard: ASME B40.200.

C. Case: sealed type(s); stainless steel with 5-inch nominal diameter.

D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F.

E. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.

F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.

G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.

H. Window: Plain glass.

I. Ring: Stainless steel.

J. Element: Bimetal coil.

K. Pointer: Dark-colored metal.

L. Accuracy: Plus or minus 1 percent of scale range.

2.2 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Type: Stepped shank unless straight or tapered shank is indicated.
5. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
6. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
7. Bore: Diameter required to match thermometer bulb or stem.
8. Insertion Length: Length required to match thermometer bulb or stem.
9. Lagging Extension: Include on thermowells for insulated piping and tubing.
10. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.3 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Flo Fab Inc.
b. Miljoco Corporation.
c. REOTEMP Instrument Corporation.
d. Weiss Instruments, Inc.
e. Weksler Glass Thermometer Corp.

2. Standard: ASME B40.100.

3. Case: Liquid-filled type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Metal.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.4 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass ball, with NPS 1/4, ASME B1.20.1 pipe threads.

2.5 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Flow Design, Inc.
2. Miljoco Corporation.
3. WATTS.
4. Weiss Instruments, Inc.
5. Weksler Glass Thermometer Corp.

B. Description: Test-station fitting made for insertion into piping tee fitting.

C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: NPS 1/4, ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

F. Core Inserts: EPDM self-sealing rubber.

2.6 TEST-PLUG KITS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Flow Design, Inc.
2. Miljoco Corporation.
3. WATTS.
4. Weiss Instruments, Inc.

B. Furnish one test-plug kit(s) containing one thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

C. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F.

D. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.

E. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch- diameter dial and probe. Dial range shall be at least 0 to 200 psig.

F. Carrying Case: Metal or plastic, with formed instrument padding.

2.7 SIGHT FLOW INDICATORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. ARCHON Industries, Inc.
2. Dwyer Instruments, Inc.
3. Emerson Process Management; Rosemount Division.
4. Ernst Flow Industries.
5. John C. Ernst Co., Inc.
6. Pentair Valves & Controls; Penberthy Brand.

B. Description: Piping inline-installation device for visual verification of flow.

C. Construction: Bronze or stainless-steel body, with sight glass and ball, flapper, or paddle wheel indicator, and threaded or flanged ends.

D. Minimum Pressure Rating: 125 psig.

E. Minimum Temperature Rating: 200 deg F.

F. End Connections for NPS 2 and Smaller: Threaded.

G. End Connections for NPS 2-1/2 and Larger: Flanged.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending one-third of pipe diameter and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

H. Install remote-mounted pressure gages on panel.

I. Install valve and snubber in piping for each pressure gage for fluids.

J. Install test plugs in piping tees.

K. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.

L. Install pressure gages in the following locations:

1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.
3. Suction and discharge of each domestic water pump.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each domestic water heater shall be the following:

1. Sealed, bimetallic-actuated type.
2. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.

B. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F.

3.6 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each water service into building shall be the following:

1. Sealed, direct-mounted, metal case.
2. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.

B. Pressure gages at suction and discharge of each domestic water pump shall be the following:

1. Sealed, direct-mounted, metal case.
2. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Water Piping: 0 to 160 psi.

END OF SECTION 220519

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.
3. Steel ball valves.
4. Iron ball valves.
5. Bronze swing check valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. RS: Rising stem.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

B. Pipe, pipe or plumbing fittings, fixtures, solder and flux installed in a system providing water for human consumption shall comply with lead free requirements of California Health and Safety Code Section 116875. Provide submittal information for products third-party certified by an approved laboratory as complying with California Health and Safety Code Section 116875.

1. Certification that products comply with NSF 61 Annex G and NSF 372.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set ball valves open to minimize exposure of functional surfaces.
4. Set butterfly valves closed or slightly open.
5. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.5 for flanges on steel valves.
4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
5. ASME B16.18 for solder-joint connections.
6. ASME B31.9 for building services piping valves.

C. California Health and Safety Code Compliance: HSC 116875 for valves for potable water service. Valves for potable water service shall be third-party certified by an approved laboratory as complying with California Health and Safety Code Section 116875.

1. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 4 and larger.
2. Handlever: For quarter-turn valves smaller than NPS 4.

H. Valves in Insulated Piping:

1. Include 2-inch stem extensions.
2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

2.2 BRASS BALL VALVES

A. Brass Ball Valves, Two-Piece with Full Port and Brass Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. American Valve, Inc.
    b. Crane; Crane Energy Flow Solutions.
    c. Milwaukee Valve Company.
    d. NIBCO INC.
    e. Watts; a Watts Water Technologies company.

2. Description:

    a. Standard: MSS SP-110.
    b. CWP Rating: 600 psig.
    c. Body Design: Two piece.
    d. Body Material: Forged brass.
    e. Ends: Threaded and soldered. See valve schedule articles.
    f. Seats: PTFE.
    g. Stem: Brass.
    h. Ball: Chrome-plated brass.
    i. Port: Full.

B. Brass Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Apollo Valves; Conbraco Industries, Inc.
    b. FNW; Ferguson Enterprises, Inc.
    c. Jomar Valve.
    d. KITZ Corporation.
    e. Marwin Valve; Richards Industries.
    f. Milwaukee Valve Company.

2. Description:

    a. Standard: MSS SP-110.
    b. CWP Rating: 600 psig.
    c. Body Design: Two piece.
    d. Body Material: Forged brass.
    e. Ends: Threaded and soldered. See valve schedule articles.
    f. Seats: PTFE.
    g. Stem: Stainless steel.

h. Ball: Stainless steel, vented.
i. Port: Full.

C. Brass Ball Valves, Three-Piece with Full Port and Brass Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Jomar Valve.
b. KITZ Corporation.
c. Watts; a Watts Water Technologies company.

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: Three piece.
d. Body Material: Forged brass.
e. Ends: Threaded and soldered. See valve schedule articles.
f. Seats: PTFE.
g. Stem: Brass.
h. Ball: Chrome-plated brass.
i. Port: Full.

2.3 BRONZE BALL VALVES

A. Bronze Ball Valves, Two-Piece with Full Port, and Bronze or Brass Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
a. Crane; Crane Energy Flow Solutions.
b. Milwaukee Valve Company.
c. NIBCO INC.
d. Watts; a Watts Water Technologies company.
e. Zurn Industries, LLC.

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: Two piece.

d. Body Material: Bronze.
e. Ends: Threaded and soldered. See valve schedule articles.
f. Seats: PTFE.
g. Stem: Bronze or brass.
h. Ball: Chrome-plated brass.
i. Port: Full.

B. Bronze Ball Valves, Three-Piece with Full Port and Bronze or Brass Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
   a. Milwaukee Valve Company.
   b. NIBCO INC.
   c. Watts; a Watts Water Technologies company.

2. Description:

   a. Standard: MSS SP-110.
   b. CWP Rating: 600 psig.
   c. Body Design: Three piece.
   d. Body Material: Bronze.
   e. Ends: Threaded and soldered. See valve schedule articles.
   f. Seats: PTFE.
   g. Stem: Bronze or brass.
   h. Ball: Chrome-plated brass.
   i. Port: Full.

2.4 STEEL BALL VALVES

A. Steel Ball Valves with Full Port, Class 150:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Apollo Valves; Conbraco Industries, Inc.
   b. Jamesbury; Metso.
   c. NIBCO INC.

2. Description:

   a. Standard: MSS SP-72.
   b. CWP Rating: 285 psig.
   c. Body Design: Split body.
   d. Body Material: Carbon steel, ASTM A 216, Type WCB.
   e. Ends: Flanged or threaded. See valve schedule articles.
   f. Seats: PTFE.
   g. Stem: Stainless steel.
   h. Ball: Stainless steel, vented.
   i. Port: Full.

2.5 IRON BALL VALVES

A. Iron Ball Valves, Class 125:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Apollo Valves; Conbraco Industries, Inc.
   b. Conbraco Industries, Inc.

c. KITZ Corporation.
d. Watts; a Watts Water Technologies company.
e. Zurn Industries, LLC.

2. Description:

a. Standard: MSS SP-72.
b. CWP Rating: 200 psig.
c. Body Design: Split body.
d. Body Material: ASTM A 126, gray iron.
e. Ends: Flanged or threaded . See valve schedule articles.
f. Seats: PTFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel.
i. Port: Full.

2.6 BRONZE SWING CHECK VALVES

A. Bronze Swing Check Valves with Bronze Disc, Class 125:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. American Valve, Inc.
b. Crane; Crane Energy Flow Solutions.
c. Jenkins Valves; Crane Energy Flow Solutions.
d. KITZ Corporation.
e. NIBCO INC.
f. Watts; a Watts Water Technologies company.

2. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 200 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded or soldered. See valve schedule articles.
f. Disc: Bronze.

B. Bronze Swing Check Valves with Nonmetallic Disc, Class 125:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
a. .
b. KITZ Corporation.
c. Milwaukee Valve Company.
d. NIBCO INC.
e. Watts; a Watts Water Technologies company.

2. Description:

a. Standard: MSS SP-80, Type 4.
b. CWP Rating: 200 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded or soldered. See valve schedule articles.
f. Disc: PTFE.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.

F. Install valve tags. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball valves.
2. Pump-Discharge Check Valves:

a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.

B. If valves with specified CWP ratings are not available, the same types of valves with higher CWP ratings may be substituted.

C. Select valves with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Two and Three piece, full port, brass or bronze with brass or bronze trim.
3. Bronze Swing Check Valves: Class 125, bronze disc.

B. Pipe NPS 2-1/2 and Larger:

1. Steel and Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Class 150, steel ball valves with full port.
3. Iron Ball Valves: Class 125.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Fastener systems.
5. Pipe-positioning systems.
6. Equipment supports.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 220516 "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
3. Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Environmental Product Declaration: For each product.
3. Health Product Declaration: For each product.
4. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Include design calculations for designing trapeze hangers.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to CBC and ASCE/SEI 7, as referenced by the CBC.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe and Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. B-line, an Eaton business.
    b. Flex-Strut Inc.
    c. Thomas & Betts Corporation; A Member of the ABB Group.
    d. Unistrut; Part of Atkore International.
    e. Wesanco, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
4. Channels: Continuous slotted carbon-steel channel with inturned lips.
5. Channel Width: Selected for applicable load criteria.
6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
8. Metallic Coating: Electroplated zinc.

2.5 THERMAL HANGER-SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
1. Carpenter & Paterson, Inc.
2. Clement Support Services.
3. ERICO International Corporation.
4. National Pipe Hanger Corporation.
5. Pipe Shields Inc.
6. Piping Technology & Products, Inc.
7. Rilco Manufacturing Co., Inc.
8. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100-psigor ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with 100-psig minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used. Refer to structural Drawings.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. B-line, an Eaton business.
    b. Empire Tool and Manufacturing Co., Inc.
    c. Hilti, Inc.
    d. ITW Ramset/Red Head; Illinois Tool Works, Inc.
    e. MKT Fastening, LLC.

2. Indoor Applications: Zinc-coated steel.
3. Outdoor Applications: Stainless steel.

2.7 PIPE-POSITIONING SYSTEMS

A. Description: IAPMO PS 42 positioning system composed of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-carbon-steel shapes.

2.9 MATERIALS

A. Aluminum: ASTM B221.

B. Carbon Steel: ASTM A1011/A1011M.

C. Structural Steel: ASTM A36/A36M carbon-steel plates, shapes, and bars; black and galvanized.

D. Stainless Steel: ASTM A240/A240M.

E. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A36/A36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:
1. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe-Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.

L. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

N. Insulated Piping:

1. Attach clamps and spacers to piping.

   a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

   a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
   b. NPS 4: 12 inches long and 0.06 inch thick.
   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
   d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
   e.

5. Pipes NPS 8 and Larger: Include reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment, and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded, shop-painted areas on miscellaneous metal are specified in Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal hanger-shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction occurs.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction occurs.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction occurs but vertical adjustment is unnecessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction occurs and vertical adjustment is unnecessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation, in addition to expansion and contraction, is required.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment of up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11 split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

O. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

Q. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

R. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220548 - VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Open-spring isolators.
5. Housed-spring isolators.
6. Restrained-spring isolators.
7. Housed-restrained-spring isolators.
8. Pipe-riser resilient supports.
9. Resilient pipe guides.
10. Elastomeric hangers.
11. Spring hangers.
12. Snubbers.
13. Restraint channel bracings.
14. Restraint cables.
15. Seismic-restraint accessories.
16. Mechanical anchor bolts.

B. Related Requirements:

1. Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment" for devices for fire-suppression equipment and systems.
2. Section 230548 "Vibration and Seismic Controls for HVAC" for devices for HVAC equipment and systems.

1.3 DEFINITIONS

A. OSHPD: Office of Statewide Health Planning & Development (for the State of California).

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.

    a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by OSHPD.
    b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Shop Drawings:

1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment.

C. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.

1. Calculations performed for use in selection of seismic supports, anchorages, and restraints shall utilize criteria indicated in Structural Contract Documents.
2. Supports, anchorage and restraints for piping, ductwork, and equipment shall be an OSHPD pre-approved system such as Tolco, ISAT, Mason, or equal. Pipes, ducts and equipment shall be seismically restrained in accordance with requirements of current edition of California Building Code. System shall have current OPM number and shall meet additional requirements of authority having jurisdiction. Provide supporting documentation required by the reviewing authority and the Architect and Engineer. Provide layout drawings showing piping, ductwork and restraint locations.

    a. Bracing of Piping and Equipment: Specifically state how bracing attachment to structure is accomplished. Provide shop drawings indicating seismic restraints, including details of anchorage to building. In-line equipment must be braced independently of piping, and in conformance with applicable building codes. Provide calculations to show that pre-approval numbers have been correctly applied in accordance with general information notes of pre-approval documentation. Gas pipe bracing shall be designed in accordance with California Building Code Section 1615A.1.22 and ASCE 7-10 Section 13.6. Coefficient $I_p = 1.5$ shall be used for gas piping bracing calculations.

3. In lieu of the above or for non-standard installations not covered in the above pre-approved systems, Contractor shall provide layout drawings showing piping, ductwork, and restraint locations, and detail supports, attachments and restraints, and furnish supporting calculations and legible details sealed by a California registered structural engineer, in accordance with 2016 California Building Code
4. Additional Requirements: In addition to the above, conform to all state and local requirements.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for plumbing piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any. Refer to Section 22 00 50, “Common Work Results for Plumbing Systems for additional requirements.

B. Qualification Data: For professional engineer and testing agency.

C. Welding certificates.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the CBC unless requirements in this Section are more stringent.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPM number from OSHPD, showing maximum seismic-restraint ratings. For additional requirements, refer to article, Action Submittals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. See structural documents for wind and seismic restraint loads.

B. Rated strengths, features, and applications shall be as defined in reports by OSHPD or provide calculations, signed and sealed by a qualified structural engineer registered in the State of California.

2.2 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads: .

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
   a. Kinetics Noise Control, Inc.
   b. Mason Industries, Inc.
   c. Vibration Isolation.
   d. Vibration Mountings & Controls, Inc.

2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
3. Size: Factory or field cut to match requirements of supported equipment.
4. Pad Material: Oil and water resistant with elastomeric properties.
5. Surface Pattern: Smooth pattern.
6. Infused nonwoven cotton or synthetic fibers.
7. Load-bearing metal plates adhered to pads.
8. Sandwich-Core Material: Resilient and elastomeric.

   a. Surface Pattern: Smooth pattern.
   b. Infused nonwoven cotton or synthetic fibers.

2.3 ELASTOMERIC ISOLATION MOUNTS

A. Double-Deflection, Elastomeric Isolation Mounts: .

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
   a. Kinetics Noise Control, Inc.
   b. Mason Industries, Inc.
   c. Vibration Isolation.
   d. Vibration Mountings & Controls, Inc.

2. Mounting Plates:

   a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.
   b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.

3. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.4 RESTRAINED ELASTOMERIC ISOLATION MOUNTS

A. Restrained Elastomeric Isolation Mounts: .

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
   a. Kinetics Noise Control, Inc.
   b. Mason Industries, Inc.
   c. Novia; A Division of C&P.
   d. Vibration Isolation.
   e. Vibration Mountings & Controls, Inc.

2. Description: All-directional isolator with seismic restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

   a. Housing: Cast-ductile iron or welded steel.
   b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.5 OPEN-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators: .

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
   a. Kinetics Noise Control, Inc.
   b. Mason Industries, Inc.
   c. Vibration Isolation.
   d. Vibration Mountings & Controls, Inc.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates shall limit floor load to 500 psig.
7. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

2.6 HOUSED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing: .

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
   a. Kinetics Noise Control, Inc.
   b. Mason Industries, Inc.
   c. Vibration Isolation.
   d. Vibration Mountings & Controls, Inc.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.

   a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
   b. Top housing with attachment and leveling bolt.

2.7 RESTRAINED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators with Vertical-Limit Stop Restraint: .

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
   a. Kinetics Noise Control, Inc.
   b. Mason Industries, Inc.
   c. Vibration Isolation.
   d. Vibration Mountings & Controls, Inc.

2. Housing: Steel housing with vertical-limit stops to prevent spring extension due to weight being removed.

   a. Base with holes for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
   b. Top plate with threaded mounting holes.

c. Internal leveling bolt that acts as blocking during installation.

3. Restraint: Limit stop as required for equipment and authorities having jurisdiction.
4. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
5. Minimum Additional Travel: 50 percent of the required deflection at rated load.
6. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
7. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.8 HOUSED-RESTRAINED-SPRING ISOLATORS

A. Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing: .

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.
f. Vibration Eliminator Co., Inc.
g. Vibration Isolation.
h. Vibration Mountings & Controls, Inc.

2. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with adjustable snubbers to limit vertical movement.

a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
b. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.

3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.9 PIPE-RISER RESILIENT SUPPORT

A. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch-thick neoprene.

1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
2. Maximum Load Per Support: 500 psig on isolation material providing equal isolation in all directions.

2.10 RESILIENT PIPE GUIDES

A. Description: Telescopic arrangement of two steel tubes or post and sleeve arrangement separated by a minimum 1/2-inch-thick neoprene.

1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.11 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods: .

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
   a. Kinetics Noise Control, Inc.
   b. Mason Industries, Inc.
   c. Vibration Eliminator Co., Inc.
   d. Vibration Mountings & Controls, Inc.

2. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
3. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

2.12 SPRING HANGERS

A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression: .

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Kinetics Noise Control, Inc.
   b. Mason Industries, Inc.
   c. Vibration Isolation.
   d. Vibration Mountings & Controls, Inc.

2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
9. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

2.13 SNUBBERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Kinetics Noise Control, Inc.
2. Mason Industries, Inc.
3. Vibration Mountings & Controls, Inc.

B. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
3. Maximum 1/4-inch air gap, and minimum 1/4-inch-thick resilient cushion.

2.14 RESTRAINT CHANNEL BRACINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. B-line, an Eaton business.
2. Hilti, Inc.
3. Mason Industries, Inc.
4. Unistrut; Part of Atkore International.

B. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.15 RESTRAINT CABLES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Kinetics Noise Control, Inc.
2. Mason Industries, Inc.
3. Vibration Mountings & Controls, Inc.

B. Restraint Cables: ASTM A 603 galvanized-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.16 SEISMIC-RESTRAINT ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. B-line, an Eaton business.
2. Kinetics Noise Control, Inc.
3. Mason Industries, Inc.
4. TOLCO.

B. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connectionsor reinforcing steel angle clamped to hanger rod.

C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.

D. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.17 MECHANICAL ANCHOR BOLTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. B-line, an Eaton business.
2. Hilti, Inc.
3. Kinetics Noise Control, Inc.
4. Mason Industries, Inc.

B. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by OSHPD.

B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."

B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

C. Equipment Restraints:

1. Install seismic snubbers on plumbing equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
3. Install seismic-restraint devices using methods approved by OSHPD that provides required submittals for component.

D. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
3. Brace a change of direction longer than 12 feet.

E. Install cables so they do not bend across edges of adjacent equipment or building structure.

F. Install seismic-restraint devices using methods approved by OSHPD that provides required submittals for component.

G. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

H. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

I. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

J. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 221116 "Domestic Water Piping" for piping flexible connections.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

END OF SECTION 220548

This page intentionally left blank.

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
   a. Brimar Industries, Inc.
   b. Craftmark Pipe Markers.
   c. Marking Services, Inc.
   d. Seton Identification Products.

2. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
3. Letter Color: White.
4. Background Color: Black.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
   a. Brimar Industries, Inc.
   b. Craftmark Pipe Markers.
   c. Marking Services, Inc.
   d. Seton Identification Products.

2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

3. Letter Color: White.
4. Background Color: Black.
5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
8. Fasteners: Stainless-steel rivets or self-tapping screws.
9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
1. Brimar Industries, Inc.
2. Craftmark Pipe Markers.
3. Marking Services Inc.

4. National Marker Company.
5. Seton Identification Products.
6. Stranco, Inc.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

C. Letter Color: Red.

D. Background Color: Yellow.

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

H. Fasteners: Stainless-steel rivets or self-tapping screws.

I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

J. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
1. Brimar Industries, Inc.
2. Craftmark Pipe Markers.
3. Marking Services Inc.
4. Seton Identification Products.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

2.4 STENCILS

A. Stencils for Piping:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Brimar Industries, Inc.
   b. Carlton Industries, LP.
   c. Champion America.
   d. Craftmark Pipe Markers.
   e. Kolbi Pipe Marker Co.
   f. Marking Services Inc.

2. Lettering Size: Size letters according to ASME A13.1 for piping.
3. Stencil Material: Aluminum.
4. Stencil Paint: Exterior, gloss, acrylic enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
5. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.

2.5 VALVE TAGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
   1. Brimar Industries, Inc.
   2. Craftmark Pipe Markers.
   3. Marking Services Inc.
   4. Seton Identification Products.

B. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link chain.

C. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
   1. Brimar Industries, Inc.
   2. Craftmark Pipe Markers.
   3. Marking Services Inc.

4. Seton Identification Products.

B. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Safety yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Piping Color Coding: Painting of piping is specified in Section 099123 "Interior Painting" and Section 099600 "High-Performance Coatings."

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

E. Pipe Label Color Schedule:

1. Domestic Water Piping

a. Background: Safety green.
b. Letter Colors: White.

2. Sanitary Waste and Storm Drainage Piping:

a. Background Color: Safety black.
b. Letter Color: White.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

a. Cold Water: 1-1/2 inches, round.
b. Hot Water: 1-1/2 inches, round.
c. Gas: 1-1/2 inches, round.

2. Valve-Tag Colors:

a. Cold Water: Natural.
b. Hot Water: Natural.

3. Letter Colors:

a. Cold Water: White.
b. Hot Water: White.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 220553

This page intentionally left blank.

SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping outside building thermal envelope.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.
4. Roof drains and rainwater leaders.
5. Supplies and drains for handicap-accessible lavatories and sinks.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at pipe expansion joints for each type of insulation.
3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
4. Detail removable insulation at piping specialties, equipment connections, and access panels.
5. Detail application of field-applied jackets.
6. Detail application at linkages of control devices.

C. Product Data for California Green Building Standards Code Compliance: For adhesives and sealants, including primers, documentation of compliance including printed statement of VOC content and chemical components.

D. Product data for insulation products, including insulation, insulation facings, jackets, adhesives, sealants, and coatings, indicating compliance with requirement that these products contain less than 0.1 percent (by mass) polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

C. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).

C. Products shall not contain asbestos, lead, mercury, or mercury compounds.

D. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

E. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

F. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

G. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Pittsburgh Corning Corporation.

2. Block Insulation: ASTM C 552, Type I.
3. Special-Shaped Insulation: ASTM C 552, Type III.
4. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
5. Preformed Pipe Insulation with Factory-Applied ASJ-SSL: Comply with ASTM C 552, Type II, Class 2.
6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

H. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Aeroflex USA, Inc.
    b. Armacell LLC.
    c. K-Flex USA.

I. Mineral-Fiber, Preformed Pipe Insulation:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Johns Manville; a Berkshire Hathaway company.
b. Knauf Insulation.
c. Manson Insulation Inc.
d. Owens Corning.

2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Ramco Insulation, Inc.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Ramco Insulation, Inc.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Ramco Insulation, Inc.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Foster Brand; H. B. Fuller Construction Products.
2. Adhesive: As recommended by cellular glass manufacturer and with a VOC content of 80 g/L or less.
3. Adhesive shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

C. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Aeroflex USA, Inc.
    b. Armacell LLC.
    c. Foster Brand; H. B. Fuller Construction Products.
    d. K-Flex USA.
2. Adhesive: As recommended by flexible elastomeric manufacturer and with a VOC content of 80 g/L or less.
3. Adhesive shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Eagle Bridges - Marathon Industries.
    c. Foster Brand; H. B. Fuller Construction Products.
    d. Mon-Eco Industries, Inc.
2. Adhesive: As recommended by mineral fiber manufacturer and with a VOC content of 80 g/L or less.
3. Adhesive shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

E. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Eagle Bridges - Marathon Industries.
    c. Foster Brand; H. B. Fuller Construction Products.
    d. Mon-Eco Industries, Inc.
2. Adhesives shall have a VOC content of 80 g/L or less.
3. Adhesive shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

F. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Dow Corning Corporation.
    b. Johns Manville; a Berkshire Hathaway company.
    c. P.I.C. Plastics, Inc.
    d. Speedline Corporation.
2. Adhesive: As recommended by Adhesive - PVC Jacket manufacturer and with a VOC content of 50 g/L or less.
3. Adhesive shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. Mastics: As recommended by insulation manufacturer and with a VOC content of 50 g/L or less.

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Foster Brand; H. B. Fuller Construction Products.
b. Knauf Insulation.
c. Vimasco Corporation.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Childers Brand; H. B. Fuller Construction Products.
b. Eagle Bridges - Marathon Industries.
c. Foster Brand; H. B. Fuller Construction Products.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

D. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Childers Brand; H. B. Fuller Construction Products.
b. Eagle Bridges - Marathon Industries.
c. Foster Brand; H. B. Fuller Construction Products.
d. Knauf Insulation.
e. Mon-Eco Industries, Inc.
f. Vimasco Corporation.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Foster Brand; H. B. Fuller Construction Products.
    c. Vimasco Corporation.

4. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
5. Service Temperature Range: 0 to plus 180 deg F.
6. Color: White.

2.6 SEALANTS

A. Joint Sealants for Cellular-Glass Products:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Eagle Bridges - Marathon Industries.
    c. Foster Brand; H. B. Fuller Construction Products.
    d. Mon-Eco Industries, Inc.
    e. Pittsburgh Corning Corporation.

2. Sealant shall have a VOC content of 420 g/L or less.
3. Sealant shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

B. Metal Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Eagle Bridges - Marathon Industries.
    c. Foster Brand; H. B. Fuller Construction Products.
    d. Mon-Eco Industries, Inc.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.

4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. Sealant shall have a VOC content of 420 g/L or less.
7. Sealant shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

C. ASJ Flashing Sealants, and PVC Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Childers Brand; H. B. Fuller Construction Products.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. Sealant shall have a VOC content of 420 g/L or less.
7. Sealant shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Childers Brand; H. B. Fuller Construction Products.

B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Foster Brand; H. B. Fuller Construction Products.
   b. Vimasco Corporation.

2.9 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Alpha Associates, Inc.

2.10 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Johns Manville; a Berkshire Hathaway company.
b. P.I.C. Plastics, Inc.
c. Proto Corporation.
d. Speedline Corporation.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

C. Metal Jacket:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Childers Brand; H. B. Fuller Construction Products.
b. ITW Insulation Systems; Illinois Tool Works, Inc.
c. RPR Products, Inc.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. Sheet and roll stock ready for shop or field sizing or Factory cut and rolled to size.
b. Finish and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
d. Moisture Barrier for Outdoor Applications: 2.5-mil- thick polysurlyn.
e. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.11 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Avery Dennison Corporation, Specialty Tapes Division.
b. Compac Corporation.
c. Ideal Tape Co., Inc,; an American Biltrite company.
d. Knauf Insulation.
e. Venture Tape.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Compac Corporation.
b. Ideal Tape Co., Inc,; an American Biltrite company.
c. Venture Tape.

2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Avery Dennison Corporation, Specialty Tapes Division.
b. Compac Corporation.
c. Ideal Tape Co., Inc,; an American Biltrite company.
d. Knauf Insulation.
e. Venture Tape.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.12 SECUREMENTS

A. Bands:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. ITW Insulation Systems; Illinois Tool Works, Inc.
b. RPR Products, Inc.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless steel.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. C & F Wire.

2.13 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Engineered Brass Company.
b. Insul-Tect Products Co.
c. McGuire Manufacturing.
d. Plumberex Specialty Products, Inc.
e. Truebro.
f. Zurn Industries, LLC.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.

4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams,

and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.9 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.10 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099123 "Interior Painting, and Section 099600, “High Performance Coatings"

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum jackets.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.12 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.13 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water and Industrial Cold Water Outside Building Thermal Envelope:

1. All Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Domestic Hot and Recirculated Hot Water:

1. NPS 3/4 and Smaller: Insulation shall be one of the following:

a. Cellular Glass: 2 inches thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

2. NPS 1 and Larger: Insulation shall be one of the following:

a. Cellular Glass: 3 inches thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch thick.

C. Stormwater and Overflow: (Insulate rainwater leader piping and overflow drain piping from drain to first horizontal offset, and first 5 feet of horizontal piping)

1. All Pipe Sizes: Insulation shall be the following:
a. Flexible Elastomeric: 1 inch thick.

D. Roof Drain and Overflow Drain Bodies:

1. All Pipe Sizes: Insulation shall be the following:
a. Flexible Elastomeric: 1 inch thick.

E. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be the following:

F. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be the following:
   a. Flexible Elastomeric: 1 inch thick.

G. Hot Service Drains:

1. All Pipe Sizes: Insulation shall be one of the following:

   a. Cellular Glass: 1-1/2 inches thick.
   b. Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch thick.

H. Hot Service Vents:

1. All Pipe Sizes: Insulation shall be one of the following:

   a. Cellular Glass: 1-1/2 inches thick.
   b. Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch thick.

3.14 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Domestic Water Piping:

1. All Pipe Sizes: Insulation shall be one of the following:

   a. Cellular Glass: 2 inches thick.
   b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

3.15 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.

D. Piping, Exposed:

1. PVC: 30 mils thick.

3.16 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Exposed:

1. Painted Aluminum, Smooth with Z-Shaped Locking Seam: 0.024 inch thick.

END OF SECTION 220719

This page intentionally left blank.

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. Piping joining materials.
3. Encasement for piping.
4. Transition fittings.
5. Dielectric fittings.

B. Related Requirements:

1. Section 311000 "Site Water Utilities" for water-service piping outside the building from source to the point where water-service piping enters the building.

1.3 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

B. Pipe, pipe or plumbing fittings, fixtures, solder and flux installed in a system providing water for human consumption shall comply with lead free requirements of California Health and Safety Code Section 116875. Provide submittal information for products third-party certified by an approved laboratory as complying with California Health and Safety Code Section 116875.

1. Certification that products comply with NSF 61 Annex G and NSF 372.

C. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.

1.4 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. California Health and Safety Code Compliance: For products covered under the scope of HSC 116875 for potable water service. Products for potable water service shall be third-party certified by an approved laboratory as complying with California Health and Safety Code Section 116875.

1.6 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Owner and Construction Manager no fewer than two days in advance of proposed interruption of water service.
2. Do not interrupt water service without Owner’s and Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 61 Annex G.

C. Comply with NSF Standard 372 for low lead.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L and ASTM B 88, Type M water tube, drawn temper.

B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

F. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105/A21.5.

B. Form: Sheet or tube.

C. Color: Black or natural.

2.5 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Cascade Waterworks Mfg. Co.
b. Dresser, Inc.
c. Ford Meter Box Company, Inc. (The).
d. Jay R. Smith Mfg. Co.
e. JCM Industries, Inc.
f. Romac Industries, Inc.
g. Smith-Blair, Inc.
h. Viking Johnson.

D. Plastic-to-Metal Transition Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Charlotte Pipe and Foundry Company.
    b. Harvel Plastics, Inc.
    c. Spears Manufacturing Company.
    d. Uponor.

2. Description:

    a. CPVC or PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
    b. One end with threaded brass insert and one solvent-cement-socket or threaded end.

E. Plastic-to-Metal Transition Unions:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Colonial Engineering, Inc.
    b. NIBCO INC.
    c. Spears Manufacturing Company.

2. Description:

    a. CPVC or PVC four-part union.
    b. Brass or stainless-steel threaded end.
    c. Solvent-cement-joint or threaded plastic end.
    d. Rubber O-ring.
    e. Union nut.

2.6 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. A.Y. McDonald Mfg. Co.
    b. Capitol Manufacturing Company.
    c. Central Plastics Company.
    d. HART Industrial Unions, LLC.
    e. Jomar Valve.
    f. Matco-Norca.
    g. Watts; a Watts Water Technologies company.
    h. Wilkins.
    i. Zurn Industries, LLC.

2. Standard: ASSE 1079.

3. Pressure Rating: 125 psig minimum at 180 deg F.
4. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Capitol Manufacturing Company.
    b. Central Plastics Company.
    c. Matco-Norca.
    d. Watts; a Watts Water Technologies company.
    e. Wilkins.
    f. Zurn Industries, LLC.

2. Standard: ASSE 1079.

3. Factory-fabricated, bolted, companion-flange assembly.
4. Pressure Rating: 125 psig minimum at 180 deg F.
5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Advance Products & Systems, Inc.
    b. Calpico, Inc.
    c. Central Plastics Company.
    d. Pipeline Seal and Insulator, Inc.

2. Nonconducting materials for field assembly of companion flanges.
3. Pressure Rating: 150 psig.
4. Gasket: Neoprene or phenolic.
5. Bolt Sleeves: Phenolic or polyethylene.
6. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Elster Perfection Corporation.
    b. Grinnell Mechanical Products.
    c. Matco-Norca.
    d. Precision Plumbing Products.
    e. Victaulic Company.

2. Standard: IAPMO PS 66.

3. Electroplated steel nipple complying with ASTM F 1545.

4. Pressure Rating and Temperature: 300 psig at 225 deg F.
5. End Connections: Male threaded or grooved.
6. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earthwork."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105/A21.5.

D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."

E. Install shutoff valve immediately upstream of each dielectric fitting.

F. Install domestic water piping level and plumb.

G. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

I. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

K. Install piping to permit valve servicing.

L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

M. Install piping free of sags and bends.

N. Install fittings for changes in direction and branch connections.

O. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

P. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."

Q. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."

R. Install thermometers on outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."

S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

F. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.5 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support vertical piping and tubing at base and at each floor.

D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
6. NPS 8: 10 feet with 3/4-inch rod.

E. Install supports for vertical copper tubing every 10 feet.

F. Support piping and tubing not listed in this article according to MSS SP-58 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.8 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

B. Label pressure piping with system operating pressure.

3.9 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

    a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
    b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
    c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
    d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
    e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
    f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.10 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

    a. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Repeat procedures if biological examination shows contamination.
e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Clean non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.12 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller, shall be the following:

1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.

E. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be the following:

1. Soft copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.

F. Aboveground domestic water piping, NPS 1-1/4 and smaller, shall be the following:

1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.

G. Aboveground domestic water piping, NPS 1-1/2 and larger, shall be the following:

1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and brazed joints.

3.13 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Balancing valves.
4. Temperature-actuated, water mixing valves.
5. Strainers.
6. Hose bibbs.
7. Drain valves.
8. Water-hammer arresters.
9. Trap-seal primer valves.
10. Flexible connectors.

B. Related Requirements:

1. Section 220519 "Meters and Gages for Plumbing Piping" for thermometers and pressure gages in domestic water piping.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Pipe, pipe or plumbing fittings, fixtures, solder and flux installed in a system providing water for human consumption shall comply with lead free requirements of California Health and Safety Code Section 116875. Provide submittal information for products third-party certified by an approved laboratory as complying with California Health and Safety Code Section 116875.

1. Certification that products comply with NSF 61 Annex G and NSF 372.

C. Shop Drawings: For domestic water piping specialties.

1. Include diagrams for power, signal, and control wiring.

D. Sustainable Design Submittals:

1. Product Data: For water consumption.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. California Health and Safety Code Compliance: For products covered under the scope of HSC 116875 for potable water service. Products for potable water service shall be third-party certified by an approved laboratory as complying with California Health and Safety Code Section 116875.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 Annex G, and NSF 372.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Apollo Valves; Conbraco Industries, Inc.
    b. FEBCO.
    c. Watts; a Watts Water Technologies company.
    d. Zurn Industries, LLC.

2. Standard: ASSE 1001.
3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Chrome plated.

B. Hose-Connection Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Apollo Valves; Conbraco Industries, Inc.
    b. Arrowhead Brass Products.
    c. Cash Acme.
    d. Legend Valve & Fitting, Inc.
    e. MIFAB, Inc.
    f. Prier Products, Inc.
    g. Watts; a Watts Water Technologies company.
    h. Woodford Manufacturing Company.
    i. Zurn Industries, LLC.
2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated.

2.4 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Ames Co.
    b. Ames Fire & Waterworks.
    c. FEBCO.
    d. Watts; a Watts Water Technologies company.
    e. Zurn Industries, LLC.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
5. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
6. Accessories:

    a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
    b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
    c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

2.5 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
    a. ITT Corporation.
    b. NIBCO INC.

c. Watts; a Watts Water Technologies company.

2. Type: Ball valve with two readout ports and memory-setting indicator.
3. Body: bronze.
4. Size: Same as connected piping, but not larger than NPS 2.
5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.6 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Leonard Valve Company.
b. Powers.
c. Watts; a Watts Water Technologies company.
d. Zurn Industries, LLC.

2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig.
4. Type: Thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Tempered-Water Setting: 120 deg. F.
9. Valve Finish: Chrome plated.

B. Individual-Fixture, Water Tempering Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Leonard Valve Company.
b. Powers.
c. Watts; a Watts Water Technologies company.
d. Zurn Industries, LLC.

2. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.
4. Body: Bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Inlets and Outlet: Threaded.
7. Finish: Rough or chrome-plated bronze.
8. Tempered-Water Setting: 110 deg. F.

2.7 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:

    a. Strainers NPS 2 and Smaller: 0.062 inch.

6. Drain: Factory-installed, hose-end drain valve.

2.8 HOSE BIBBS

A. Hose Bibbs:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following, or equal:

    a. Jay R. Smith Mfg. Co.
    b. Josam Company.
    c. MIFAB, Inc.
    d. Woodford Manufacturing Company.

2. Standard: ASME A112.18.1 for sediment faucets.
3. Body Material: Bronze.
4. Seat: Bronze, replaceable.
5. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
6. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
7. Pressure Rating: 125 psig.
8. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
9. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
10. Finish for Service Areas: Chrome or nickel plated.
11. Finish for Finished Rooms: Chrome or nickel plated.
12. Operation for Equipment Rooms: Wheel handle or operating key.
13. Operation for Service Areas: Operating key.
14. Operation for Finished Rooms: Operating key.
15. Include operating key with each operating-key hose bibb.
16. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.9 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.

3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

B. Stop-and-Waste Drain Valves:

1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
2. Pressure Rating: 200-psig minimum CWP or Class 125.
3. Size: NPS 3/4.
4. Body: Copper alloy or ASTM B 62 bronze.
5. Drain: NPS 1/8 side outlet with cap.

2.10 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. AMTROL, Inc.
   b. Josam Company.
   c. MIFAB, Inc.
   d. Precision Plumbing Products, Inc.
   e. Sioux Chief Manufacturing Company, Inc.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.11 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. MIFAB, Inc.
   b. Precision Plumbing Products.
   c. Sioux Chief Manufacturing Company, Inc.

2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.

7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

2.12 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Flex-Hose Co., Inc.
2. Flexicraft Industries.
3. Hyspan Precision Products, Inc.
4. Metraflex Company (The).

B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

C. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Install balancing valves in locations where they can easily be adjusted.

C. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified.

D. Install Y-pattern strainers for water on supply side of each control valve and pump.

E. Install water-hammer arresters in water piping according to PDI-WH 201.

F. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

3.2 CONNECTIONS

A. Comply with requirements for ground equipment in Section 260501 "Basic Electrical Materials and Methods."

B. Fire-retardant-treated-wood blocking is specified in Section 260530 "Conduit and Wire" for electrical connections.

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Reduced-pressure-principle backflow preventers.
2. Calibrated balancing valves.
3. Supply-type, trap-seal primer valves.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Set field-adjustable flow set points of balancing valves.

B. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION 221119

SECTION 22 11 23 - DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. In-line, sealless centrifugal pumps.

1.3 DEFINITIONS

A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include materials of construction, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Pipe, pipe or plumbing fittings, fixtures, solder and flux installed in a system providing water for human consumption shall comply with lead free requirements of California Health and Safety Code Section 11 68 75. Provide submittal information for products third-party certified by an approved laboratory as complying with California Health and Safety Code Section 11 68 75.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water pumps to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

C. California Health and Safety Code Compliance: HSC 116875 for pumps for potable water service. Pumps for potable water service shall be third-party certified by an approved laboratory as complying with California Health and Safety Code Section 11 68 75.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

C. Comply with pump manufacturer's written rigging instructions for handling.

1.8 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 IN-LINE, SEALLESS CENTRIFUGAL PUMPS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following, or equal:
1. TACO Comfort Solutions, Inc.
2. WILO USA LLC - WILO Canada Inc.

B. Description: Factory-assembled and -tested, in-line, close-coupled, canned-motor, sealless, overhung-impeller centrifugal pumps.

C. Pump Construction:

1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft horizontal.
2. Casing: Bronze, with threaded or companion-flange connections.
3. Shaft and bearing rings: Ceramic.
4. Impeller: Plastic.
5. Motor: Single speed, unless otherwise indicated.

D. Controls:
1. Illuminated display showing energy consumption, flow, and operating mode.
2. Minimum 3 constant pressure control modes of operation.

E. Capacities and Characteristics:

1. Capacity: Refer to schedules.
2. Total Dynamic Head: Refer to schedules.
3. Minimum Working Pressure: 125 psig.
4. Maximum Continuous Operating Temperature: 220 deg F.
5. Inlet and Outlet Size: Refer to schedules.
6. Pump Speed: Refer to schedules.

7. Pump Control: Aquastat.
8. Motor Horsepower: Refer to schedules.
9. Electrical Characteristics:

    a. Volts: 120.
    b. Phases: Single.
    c. Hertz: 60.

2.2 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 22 05 13 "Common Motor Requirements for Plumbing Equipment."

1. Electrically commutated motor.
2. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.3 CONTROLS

A. Thermostats: Electric; adjustable for control of hot-water circulation pump.

1. Type: Water-immersion temperature sensor, for installation in piping.
2. Range: 50 to 125 deg F.
3. Enclosure: NEMA 250, Type 4X.
4. Operation of Pump: On or off.
5. Transformer: Provide if required.
6. Power Requirement: 120 V, ac.

B. Timers: Electric, for control of hot-water circulation pump.

1. Type: Programmable, seven-day clock with manual override on-off switch.
2. Enclosure: NEMA 250, Type 1, suitable for wall mounting.
3. Operation of Pump: On or off.
4. Transformer: Provide if required.
5. Power Requirement: 120-V ac.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

3.2 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Install in-line, sealless centrifugal pumps with shaft horizontal unless otherwise indicated.

C. Install aquastat in hot-water return piping.

3.3 CONNECTIONS

A. Comply with requirements for piping specified in Section 22 11 16 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps to allow service and maintenance.

C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.

1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:

    a. Horizontally mounted, in-line, separately coupled centrifugal pumps.

D. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping. Comply with requirements for valves specified in 220523 General-Duty Valves for Plumbing Piping," and comply with requirements for strainers specified in Section 22 11 19 "Domestic Water Piping Specialties."

E. Connect aquastats to pumps that they control.

3.4 IDENTIFICATION

A. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment" for identification of pumps.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Set aquastats for automatic starting and stopping operation of pumps.
5. Perform the following startup checks for each pump before starting:

    a. Verify bearing lubrication.
    b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
    c. Verify that pump is rotating in the correct direction.

6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
7. Start motor.
8. Open discharge valve slowly.

9. Adjust temperature settings on thermostats.
10. Adjust timer settings.

3.6 ADJUSTING

A. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature set points.

C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION 221123

This page intentionally left blank.

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Related Requirements:

1. Section 333000 "Sanitary Utilities" for sanitary sewerage piping and structures outside the building.

1.2 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.
3. Encasement for underground metal piping.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 FIELD CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Owner and Construction Manager no fewer than two days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Owner’s and Construction Manager’s written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

2.2 PIPING MATERIALS

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service and Extra Heavy class(es).

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.4 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. ANACO-Husky.
b. MIFAB, Inc.
c. Tyler Pipe; a subsidiary of McWane Inc.

2. Standards: ASTM C 1277 and CISPI 310.
3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. ANACO-Husky.
b. MIFAB, Inc.

c. Tyler Pipe; a subsidiary of McWane Inc.

2. Standards: ASTM C 1277 and ASTM C 1540.
3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.5 COPPER TUBE AND FITTINGS

A. Copper Type DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Hard Copper Tube: ASTM B 88, Type L and Type M, water tube, drawn temper.

D. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.

E. Copper Pressure Fittings:

1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

F. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

G. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.6 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Unshielded, Nonpressure Transition Couplings:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1) Dallas Specialty & Mfg. Co.
2) Fernco Inc.
3) Froet Industries LLC.
4) Mission Rubber Company, LLC; a division of MCP Industries.

b. Standard: ASTM C 1173.

c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
d. End Connections: Same size as and compatible with pipes to be joined.
e. Sleeve Materials:

1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

4. Shielded, Nonpressure Transition Couplings:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1) Cascade Waterworks Mfg. Co.
2) Mission Rubber Company, LLC; a division of MCP Industries.

b. Standard: ASTM C 1460.
c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
d. End Connections: Same size as and compatible with pipes to be joined.

5. Pressure Transition Couplings:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1) Cascade Waterworks Mfg. Co.
2) Ford Meter Box Company, Inc. (The).
3) Jay R. Smith Mfg. Co.
4) JCM Industries, Inc.
5) Viking Johnson.

b. Standard: AWWA C219.
c. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
d. Center-Sleeve Material: Manufacturer's standard.
e. Gasket Material: Natural or synthetic rubber.
f. Metal Component Finish: Corrosion-resistant coating or material.

B. Dielectric Fittings:

1. Dielectric Unions:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1) A.Y. McDonald Mfg. Co.
2) Capitol Manufacturing Company.
3) Central Plastics Company.
4) HART Industrial Unions, LLC.
5) Jomar Valve.

6) Matco-Norca.
7) Watts; a Watts Water Technologies company.
8) Wilkins.
9) Zurn Industries, LLC.

b. Description:

1) Standard: ASSE 1079.
2) Pressure Rating: 150 psig.
3) End Connections: Solder-joint copper alloy and threaded ferrous.

2. Dielectric Flanges:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1) Capitol Manufacturing Company.
2) Central Plastics Company.
3) Matco-Norca.
4) Watts; a Watts Water Technologies company.
5) Wilkins.
6) Zurn Industries, LLC.

b. Description:

1) Standard: ASSE 1079.
2) Factory-fabricated, bolted, companion-flange assembly.
3) Pressure Rating: 150 psig.
4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

3. Dielectric-Flange Insulating Kits:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1) Advance Products & Systems, Inc.
2) Calpico, Inc.
3) Central Plastics Company.
4) Pipeline Seal and Insulator, Inc.

b. Description:

1) Nonconducting materials for field assembly of companion flanges.
2) Pressure Rating: 150 psig.
3) Gasket: Neoprene or phenolic.
4) Bolt Sleeves: Phenolic or polyethylene.
5) Washers: Phenolic with steel backing washers.

4. Dielectric Nipples:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1) Elster Perfection Corporation.
2) Matco-Norca.
3) Precision Plumbing Products.

b. Description:

1) Standard: IAPMO PS 66.
2) Electroplated steel nipple.
3) Pressure Rating: 300 psig at 225 deg F.
4) End Connections: Male threaded or grooved.
5) Lining: Inert and noncorrosive, propylene.

2.7 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Standard: ASTM A 674 or AWWA C105/A 21.5.

B. Material: Linear low-density polyethylene film of 0.008-inch or high-density, cross-laminated polyethylene film of 0.004-inch minimum thickness.

C. Form: Sheet or tube.

D. Color: Black or natural.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earthwork."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

K. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.

1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.

    a. Straight tees, elbows, and crosses may be used on vent lines.

3. Do not change direction of flow more than 90 degrees.
4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

    a. Reducing size of waste piping in direction of flow is prohibited.

L. Lay buried building waste piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

M. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 2 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

N. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.

O. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

P. Plumbing Specialties:

1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.

    a. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
    b. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."

2. Install drains in sanitary waste gravity-flow piping.

    a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

Q. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

R. Install sleeves for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

S. Install sleeve seals for piping penetrations of concrete walls and slabs.

1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

T. Install escutcheons for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.

C. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1.

1. Cut threads full and clean using sharp dies.
2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

    a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
    b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
    c. Do not use pipe sections that have cracked or open welds.

E. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

F. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: Unshielded, nonpressure transition couplings.

B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.
4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
3. Vertical Piping: MSS Type 8 or Type 42, clamps.
4. Install individual, straight, horizontal piping runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

5. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
6. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.

3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches with 3/8-inch rod.
2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
3. NPS 2-1/2: 108 inches with 1/2-inch rod.
4. NPS 3 - NPS 5: 10 feet with 1/2-inch rod.

H. Install supports for vertical copper tubing every 10 feet.

I. Support piping and tubing not listed above according to MSS SP-58 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect waste and vent piping to the following:

1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Comply with requirements for cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."
6. Equipment: Connect waste piping as indicated.

a. Provide shutoff valve if indicated and union for each connection.
b. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.7 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

    a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.

    a. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.

    a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. Maintain pressure for four hours.
    b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    c. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.

    a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
    b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.

c. Air pressure must remain constant without introducing additional air throughout period of inspection.
d. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

7. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
8. Prepare reports for tests and required corrective action.

3.9 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Repair damage to adjacent materials caused by waste and vent piping installation.

3.10 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.

3. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints shall be installed where piping will be located over critical areas including food preparation, food storage, food serving, dining areas, operating and delivery rooms, nurseries, and other sensitive areas.
4. In addition to materials listed above, vertical waste piping from lavatories, sinks, and drinking fountains may be any of the following:

a. Galvanized-steel pipe, drainage fittings, and threaded joints.
b. Copper DWV tube, copper drainage fittings, and soldered joints.

5. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

C. Aboveground, vent piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
3. Copper Type DWV tube, copper drainage fittings, and soldered joints.

a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2: Hard copper tube, Type M; copper pressure fittings; and soldered joints.

4. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

D. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:

1. Extra Heavy class, cast-iron soil piping; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
3. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

E. Underground, soil and waste piping NPS 5 and larger shall be any of the following:

1. Extra Heavy class, cast-iron soil piping; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; coupled joints.
3. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

END OF SECTION 221316

This page intentionally left blank.

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cleanouts.
2. Roof flashing assemblies.
3. Miscellaneous sanitary drainage piping specialties.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sanitary waste piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTIONS

A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

2.2 CLEANOUTS

A. Cast-Iron Exposed Cleanouts:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Jay R. Smith Mfg. Co.
b. Josam Company.
c. Watts; a Watts Water Technologies company.
d. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M.
3. Size: Same as connected drainage piping
4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head, brass or cast-iron plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Exposed Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Jay R. Smith Mfg. Co.
    b. Josam Company.
    c. Watts; a Watts Water Technologies company.
    d. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Threaded, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Required.
7. Outlet Connection: Inside calk or Spigot.
8. Closure: Brass plug with straight threads and gasket.
9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Medium Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Jay R. Smith Mfg. Co.
    b. Josam Company.
    c. MIFAB, Inc.
    d. Tyler Pipe; a subsidiary of McWane Inc.
    e. Watts; a Watts Water Technologies company.
    f. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M. Include wall access.

3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure Plug:

    a. Brass or Cast iron.
    b. Countersunk or raised head.
    c. Drilled and threaded for cover attachment screw.

d. Size: Same as or not more than one size smaller than cleanout size.

6. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
7. Wall Access: Round, wall-installation frame and cover.

2.3 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Acorn Engineering Company.
   b. Zurn Industries, LLC.

2. Description: Manufactured assembly made of 4.0-lb/sq. ft., 0.0625-inch- thick, lead flashing collar and skirt extending at least 6 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.
   a. Low-Silhouette Vent Cap: With vandal-proof vent cap.

2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

B. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

C. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

D. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

E. Expansion Joints:

1. Standard: ASME A112.6.4.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

2.5 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.

B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:

1. General Applications: 12 oz./sq. ft..
2. Vent Pipe Flashing: 8 oz./sq. ft..

C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.

D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

E. Fasteners: Metal compatible with material and substrate being fastened.

F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

G. Solder: ASTM B 32, lead-free alloy.

H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

1. Comply with requirements for vibration-isolation and seismic-control devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.

2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof. Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."

F. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof. Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."

G. Install deep-seal traps on floor drains and other waste outlets, if indicated.

H. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

I. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

J. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.

K. Install vent caps on each vent pipe passing through roof.

L. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

M. Install wood-blocking reinforcement for wall-mounting-type specialties.

N. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.3 FLASHING INSTALLATION

A. Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."

B. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required.

C. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

D. Set flashing on floors and roofs in solid coating of bituminous cement.

E. Secure flashing into sleeve and specialty clamping ring or device.

F. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Section 076200 "Sheet Metal Flashing and Trim."

G. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

SECTION 221319.13 - SANITARY DRAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Floor drains.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 DRAIN ASSEMBLIES

A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Basis-of-Design Product: Subject to compliance with requirements, provide products specified on Drawings, or comparable product by one of the following:

    a. Josam Company.
    b. Watts.
    c. Zurn.
    d. Or equal.

2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom.

9. Backwater Valve: Not required.
10. Coating on Interior and Exposed Exterior Surfaces: Manufacturer's standard coating.
11. Strainer Types by Drain Location: Refer to schedule on Drawings.
12. Top or Strainer Material: Nickel bronze.
13. Top of Body and Strainer Finish: Polished Nickel bronze.
14. Top Shape: Round or Square.
15. Top Loading Classification: Medium Duty.
16. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
17. Trap Material: Cast iron or Copper.
18. Trap Pattern: Standard P-trap.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
3. Set with grates depressed according to the following drainage area radii:

    a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

4. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.

    a. Maintain integrity of waterproof membranes where penetrated.

5. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

3.2 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Comply with requirements in Section 221319 "Sanitary Waste Piping Specialties" for miscellaneous sanitary drainage piping specialties.

C. Install piping adjacent to equipment to allow service and maintenance.

3.3 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319.13

This page intentionally left blank.

SECTION 22 14 13 - FACILITY STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Hubless, cast-iron soil pipe and fittings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Detail storm drainage piping. Show support locations, type of support, weight on each support, required clearances, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Structural members to which drainage piping will be attached or suspended from.
2. Refer to Section 22 00 50, “Common Work Results for Plumbing Systems for additional requirements.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.6 FIELD CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Owner and Construction Manager no fewer than seven days in advance of proposed interruption of storm drainage service.
2. Do not proceed with interruption of storm drainage service without Owner’s and Construction Manager’s written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Storm Drainage Piping: 10-foot head of water.

2.2 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. AB & I Foundry; a part of the McWane family of companies.
2. Charlotte Pipe and Foundry Company.
3. Tyler Pipe; a part of McWane family of companies.

B. Pipe and Fittings:

1. Marked with CISPI collective trademark and NSF certification mark.
2. Standard: ASTM A 888 or CISPI 301.

C. CISPI, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. ANACO-Husky.
b. Charlotte Pipe and Foundry Company.
c. MIFAB, Inc.
d. Tyler Pipe; a subsidiary of McWane Inc.

2. Couplings shall bear CISPI collective trademark and NSF certification mark.
3. Standards: ASTM C 1277 and CISPI 310.
4. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

D. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. ANACO-Husky.
b. Charlotte Pipe and Foundry Company.
c. Clamp-All Corp.
d. Ideal Clamp Products, Inc.
e. MIFAB, Inc.
f. Mission Rubber Company, LLC; a division of MCP Industries.
g. Tyler Pipe; a subsidiary of McWane Inc.

2. Standard: ASTM C 1540.
3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.3 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in ODs or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified-piping-system fitting.
3. Unshielded, Nonpressure Transition Couplings:

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

        1) Dallas Specialty & Mfg. Co.
        2) Fernco Inc.
        3) Mission Rubber Company, LLC; a division of MCP Industries.
        4) Plastic Oddities.

    b. Standard: ASTM C 1173.
    c. Description: Elastomeric sleeve, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    d. Sleeve Materials:

        1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
        2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
        3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

B. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric-Flange Insulating Kits:

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

        1) Advance Products & Systems, Inc.
        2) Calpico, Inc.
        3) Central Plastics Company.
        4) GPT; an EnPro Industries company.

    b. Description:

        1) Nonconducting materials for field assembly of companion flanges.
        2) Pressure Rating: 150 psig.
        3) Gasket: Neoprene or phenolic.
        4) Bolt Sleeves: Phenolic or polyethylene.

5) Washers: Phenolic with steel-backing washers.

3. Dielectric Nipples:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1) Grinnell Mechanical Products.
2) Matco-Norca.
3) Precision Plumbing Products.
4) Victaulic Company.

b. Description: Electroplated steel nipple.
c. Standard: IAPMO PS 66.
d. Pressure Rating: 300 psig at 225 deg F.
e. End Connections: Male threaded or grooved.
f. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 31 20 00 "Earthwork."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
2. Install piping as indicated unless deviations from layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

K. Make changes in direction for piping using appropriate branches, bends, and long-sweep bends.

1. Do not change direction of flow more than 90 degrees.
2. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

    a. Reducing size of drainage piping in direction of flow is prohibited.

L. Lay buried building piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

M. Install piping at the following minimum slopes unless otherwise indicated:

1. Building Storm Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 or 2 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Storm Drainage Piping: 1 or 2 percent downward in direction of flow.

N. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.

O. Plumbing Specialties:

1. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping.

    a. Comply with requirements for cleanouts specified in Section 22 14 23 "Storm Drainage Piping Specialties."

2. Install drains in storm drainage gravity-flow piping.

    a. Comply with requirements for drains specified in Section 22 14 23 "Storm Drainage Piping Specialties."

P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

R. Install sleeve seals for piping penetrations of concrete walls and slabs.

1. Comply with requirements for sleeve seals specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

S. Install escutcheons for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Hubless, Cast-Iron Soil Piping Coupled Joints:

1. Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

B. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1.

1. Cut threads full and clean using sharp dies.
2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
c. Do not use pipe sections that have cracked or open welds.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains and storm drainage specialties.

1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.

3.7 IDENTIFICATION

A. Identify exposed storm drainage piping.

B. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved.

a. Expose work that was covered or concealed before it was tested.

3. Test Procedure:

a. Test storm drainage piping on completion of roughing-in.
b. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. Maintain such pressure without leakage for four hours. From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.

4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

C. Piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.9 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.10 PIPING SCHEDULE

A. Aboveground storm drainage piping shall be the following:

1. Hubless, cast-iron soil pipe and fittings; CISPI, hubless-piping couplings; and coupled joints.

a. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints shall be installed where piping will be located over critical areas including food preparation, food storage, and food serving.

2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

B. Underground storm drainage piping shall be the following:

1. Hubless, cast-iron soil pipe and fittings; heavy-duty, hubless-piping couplings; and coupled joints.
2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

END OF SECTION 221413

SECTION 221423 - STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal roof drains.
2. Roof Receptors.
3. Miscellaneous storm drainage piping specialties.
4. Cleanouts.

B. Related Requirements:

1. Section 07 84 13 "Penetration Firestopping" for firestopping roof penetrations.

1.2 SUBMITTALS

A. Product Data: For each type of product.

1.3 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 METAL ROOF DRAINS

A. Cast-Iron, Large-Sump, General-Purpose Roof Drains:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Jay R. Smith Mfg. Co.
   b. Josam Company.
   c. MIFAB, Inc.
   d. Tyler Pipe; a subsidiary of McWane Inc.
   e. Watts; a Watts Water Technologies company.
   f. Zurn Industries, LLC.

2. Standard: ASME A112.6.4.
3. Body Material: Cast iron.
4. Dimension of Body: Nominal 14-to 16-inch diameter.
5. Combination Flashing Ring and Gravel Stop: Required.

6. Flow-Control Weirs: Not required.
7. Outlet: Bottom.
8. Outlet Type: No hub.
9. Extension Collars: Not required.
10. Underdeck Clamp: Required
11. Expansion Joint: Not required.
12. Sump Receiver Plate: Required.
13. Dome Material: Cast iron.
14. Perforated Gravel Guard: Not required.
15. Vandal-Proof Dome: Required.
16. Water Dam: 2 inches high on overflow drain.

2.2 ROOF RECEPTORS

A. Cast-Iron, Medium-Sump, Roof Receptors:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Jay R. Smith Mfg. Co.
    b. Josam Company.
    c. MIFAB, Inc.
    d. Zurn Industries, LLC.

2. Standard: ASME A112.6.4.
3. Body Material: Cast iron.
4. Dimension of Body: 8- to 12-inch diameter.
5. Combination Flashing Ring and Gravel Stop: Required.
6. Flow-Control Weirs: Not required.
7. Outlet: Bottom.
8. Outlet Type: No hub.
9. Extension Collars: Not required.
10. Underdeck Clamp: Required.
11. Expansion Joint: Not required.
12. Sump Receiver Plate: Required.
13. Bottom strainer with stainless steel vandal proof screws.
14. Water Dam: 2 inches high.

2.3 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

A. Conductor Nozzles:

1. Description: Bronze body with threaded inlet and bronze wall flange with mounting holes.
2. Size: Same as connected conductor.

2.4 CLEANOUTS

A. Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Smith, Jay R. Mfg. Co.
    b. Tyler Pipe; a subsidiary of McWane Inc.
    c. Watts; a Watts Water Technologies company.
    d. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M, for threaded, adjustable housing cleanouts.
3. Size: Same as connected branch.
4. Type: Threaded, adjustable housing.
5. Body or Ferrule Material: Cast iron.
6. Clamping Device: Not Required.
7. Outlet Connection: Inside calk.
8. Closure: Brass plug with straight threads and gasket.
9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top-Loading Classification: Extra-Heavy Duty.
13. Riser: ASTM A 74, Extra-Heavy class, cast-iron drainage pipe fitting and riser to cleanout.

B. Test Tees:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    a. MIFAB, Inc.
    b. Smith, Jay R. Mfg. Co.
    c. Tyler Pipe; a subsidiary of McWane Inc.
    d. Watts; a Watts Water Technologies company.
    e. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M and ASTM A 74, ASTM A 888, or CISPI 301, for cleanout test tees.
3. Size: Same as connected drainage piping.
4. Body Material: Hub-and-spigot, cast-iron soil-pipe T-branch or hubless, cast-iron soil-pipe test tee as required to match connected piping.
5. Closure Plug: Countersunk, brass.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

C. Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    a. MIFAB, Inc.
    b. Smith, Jay R. Mfg. Co.
    c. Tyler Pipe; a subsidiary of McWane Inc.
    d. Watts; a Watts Water Technologies company.
    e. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M, for cleanouts. Include wall access.
3. Size: Same as connected drainage piping.
4. Body Material: Hubless, cast-iron soil-pipe test tee as required to match connected piping.
5. Closure: Countersunk brass plug.

6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.5 FLASHING MATERIALS

A. Copper Sheet: ASTM B 152/B 152M,12 oz./sq. ft.

B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.

C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

D. Fasteners: Metal compatible with material and substrate being fastened.

E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

F. Solder: ASTM B 32, lead-free alloy.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.

1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
2. Install expansion joints, if indicated, in roof drain outlets.
3. Position roof drains for easy access and maintenance.

B. Install conductor nozzles at exposed bottom of conductors where they spill onto grade.

C. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:

1. Use cleanouts the same size as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
3. Locate cleanouts at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate cleanouts at base of each vertical storm piping conductor.

D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

F. Install test tees in vertical conductors and near floor.

G. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 22 14 13 "Facility Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of 6.0-lb/sq. ft. lead sheets, 0.0938-inch thickness or thicker. Solder joints of 4.0-lb/sq. ft. lead sheets, 0.0625-inch thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching the pipe size, with a minimum length of 10 inches and with skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221423

This page intentionally left blank.

SECTION 22 34 00 - FUEL-FIRED, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Commercial, gas-fired, high-efficiency, storage, domestic-water heaters.
2. Domestic-water heater accessories.

1.2 SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Wiring Diagrams: For power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.

1. Comply with efficiency requirements in ASHRAE 189.1, which supersede requirements in ASHRAE/IESNA 90.1.

C. ASME Compliance:

1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

E. Water Heater shall comply with the Low-NOx requirements of SCAQMD rule 1146.2, for less than 14 ng/j, or 20 ppm.

1.5 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including storage tank and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:

1) Storage Tank: Three years.
2) Controls and Other Components: One year(s).

PART 2 - PRODUCTS

2.1 MATERIALS

A. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants, and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).

2.2 COMMERCIAL, POWER-BURNER, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

A. Commercial, Power Burner, Gas-Fired, High-Efficiency, Storage, Domestic-Water Heaters:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following, or equal:

a. Bradford White Corporation.

b. PVI Industries, LLC.

c. Smith, A. O. Corporation.

2. Standard: ANSI Z21.10.3/CSA 4.3.
3. Description: Manufacturer's proprietary design to provide at least 80 percent thermal efficiency at optimum operating conditions.
4. Storage-Tank Construction: ASME-code steel with 150-psig minimum working-pressure rating.

a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.

1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

b. Lining: Glass complying with NSF 61 Annex G barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.

5. Factory-Installed Storage-Tank Appurtenances:

a. Anode Rod: Replaceable magnesium.
b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
e. Jacket: Steel with enameled finish.
f. Burner: UL 795 for power-burner, gas-fired, domestic-water heaters and natural-gas fuel.
g. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 199, electric, automatic, gas-ignition system.
h. Temperature Control: Adjustable thermostat.
i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

6. Draft Hood: Draft diverter, complying with ANSI Z21.12.

B. Capacity and Characteristics: Refer to schedules on Drawings.

2.3 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. AMTROL, Inc.
b. Honeywell Water Controls.
c. Pentair Pump Group.

2. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed butyl-rubber bladder. Include air precharge to minimum system-operating pressure at tank.
3. Construction:

a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
c. Air-Charging Valve: Factory installed.

4. Capacity and Characteristics:

a. Working-Pressure Rating: 150 psig.
b. Capacity Acceptable: Refer to schedule on Drawings.
c. Air Precharge Pressure.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.

D. Heat-Trap Fittings: ASHRAE 90.2.

E. Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in Section 22 05 23 “General-Duty Valves for Plumbing Piping.”

1. Comply with requirements for balancing valves specified in Section 22 11 19 "Domestic Water Piping Specialties."

F. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.

G. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.

H. Pressure Relief Valves: Include pressure setting less than domestic-water heater working-pressure rating.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.

I. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.

2.4 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect assembled domestic-water heaters and storage tanks specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial domestic-water heaters and storage tanks to minimum of one and one-half times pressure rating before shipment.

C. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 01 40 00 "Quality Requirements" for retesting and reinspecting requirements and Section 01 73 00 "Execution" for requirements for correcting the Work.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base. Comply with requirements for concrete base specified in Section 03 30 00 "Cast-in-Place Concrete."

1. Exception: Omit concrete bases for commercial domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
2. Maintain manufacturer's recommended clearances.
3. Arrange units so controls and devices that require servicing are accessible.

B. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 22 05 23 “General-Duty Valves for Plumbing Piping.”

C. Install gas-fired, domestic-water heaters according to NFPA 54.

1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
3. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Section 23 11 23 "Facility Natural-Gas Piping."

D. Install commercial domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

E. Install double-wall vent. Refer to Section 23 51 23, “Gas Vents.”

F. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor sink.

G. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor sinks. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 22 11 19 "Domestic Water Piping Specialties."

H. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 22 05 19 "Meters and Gages for Plumbing Piping."

I. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.

J. Fill domestic-water heaters with water.

K. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

A. Comply with requirements for domestic-water piping specified in Section 22 11 16 "Domestic Water Piping."

B. Comply with requirements for gas piping specified in Section 23 11 23 "Facility Natural-Gas Piping."

C. Drawings indicate general arrangement of piping, fittings, and specialties.

D. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 01 40 00 "Quality Requirements" for retesting and reinspecting requirements and Section 01 73 00 "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial, gas-fired, storage, domestic-water heaters. Provide minimum 2 hours training.

END OF SECTION 223400

SECTION 224213.13 - COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Water closets.
2. Flushometer valves.
3. Toilet seats.
4. Supports.

1.3 DEFINITIONS

A. Effective Flush Volume: Average of two reduced flushes and one full flush per fixture.

B. Remote Water Closet: Located more than 30 feet from other drain line connections or fixture and where less than 1.5 drainage fixture units are upstream of the drain line connection.

C. Related Requirements:

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer-Valve Repair Kits: No fewer than one of each type.

PART 2 - PRODUCTS

2.1 WALL-MOUNTED WATER CLOSETS

A. Water Closets: Wall mounted, top spud, standard and accessible.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following, or equal:

a. American Standard America.

2. Bowl:

a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
b. Material: Vitreous china.
c. Type: Siphon jet.
d. Style: Flushometer valve.
e. Height: Standard.
f. Rim Contour: Elongated.
g. Water Consumption: 1.28 gal. per flush.
h. Spud Size and Location: NPS 1-1/2; top.

3. Flushometer Valve: Refer to article, Flushometer Valves.
4. Toilet Seat: Refer to article, Toilet Seats.
5. Support: Water closet carrier.
6. Water-Closet Mounting Height: Refer to schedule on Drawings.

2.2 FLUSHOMETER VALVES

A. Lever-Handle, Diaphragm Flushometer Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following, or equal:

a. Zurn Industries, LLC.

2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Panel Finish: Chrome plated or stainless steel.

8. Style: Exposed.
9. Minimum Inlet: NPS 1.
10. Minimum Outlet: NPS 1-1/4.

2.3 TOILET SEATS

A. Toilet Seats:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. American Standard America.
   b. Bemis Manufacturing Company.
   c. Kohler Co.
   d. Olsonite Seat Co.

2. Standard: IAPMO/ANSI Z124.5.
3. Material: Plastic.
4. Type: Commercial (Heavy duty).
5. Hinge: Self-sustaining.
6. Hinge Material: Noncorroding metal.
7. Seat Cover: Not required.
8. Color: White.

2.4 SUPPORTS

A. Water Closet Carrier:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Zurn Industries, LLC.

2. Standard: ASME A112.6.1M.
3. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.

B. Examine walls and floors for suitable conditions where water closets will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Water-Closet Installation:

1. Install level and plumb according to roughing-in drawings.
2. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:

1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
2. Use carrier supports with waste-fitting assembly and seal.
3. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

C. Flushometer-Valve Installation:

1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
4. Install actuators in locations that are easy for people with disabilities to reach.

D. Install toilet seats on water closets.

E. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

F. Joint Sealing:

1. Seal joints between water closets and walls using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

3.5 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed water closets and fittings.

C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213.13

This page intentionally left blank.

SECTION 224213.16 - COMMERCIAL URINALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Urinals.
2. Flushometer valves.
3. Supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for urinals.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer-Valve Repair Kits: No fewer than one of each type.

PART 2 - PRODUCTS

2.1 WALL-HUNG URINALS

A. Urinals: Wall hung, back outlet, washout, accessible.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following, or equal:

a. American Standard America.
b. Zurn Industries, LLC.

2. Fixture:

a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
b. Material: Vitreous china.
c. Type: Washout with extended shields.
d. Strainer or Trapway: Manufacturer's standard strainer with integral trap.
e. Water Consumption: Low.
f. Spud Size and Location: NPS 3/4, top.
g. Outlet Size and Location: NPS 2, back.
h. Color: White.

3. Flushometer Valve: Refer to article, Flushometer Valves..
4. Waste Fitting:

a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
b. Size: NPS 2.

5. Support: Type I Urinal Carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture..
6. Urinal Mounting Height: Refer to Drawings.

2.2 URINAL FLUSHOMETER VALVES

A. Lever-Handle, Diaphragm Flushometer Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following, or equal:
a. Zurn Industries, LLC.

2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: Exposed.
9. Consumption: 0.125 gal. per flush.
10. Minimum Inlet: NPS 3/4.

11. Minimum Outlet: NPS 3/4.

2.3 SUPPORTS

A. Type I Urinal Carrier:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Jay R. Smith Mfg. Co.
b. Zurn Industries, LLC.

2. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before urinal installation.

B. Examine walls and floors for suitable conditions where urinals will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Urinal Installation:

1. Install urinals level and plumb according to roughing-in drawings.
2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
3. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:

1. Install supports, affixed to building substrate, for wall-hung urinals.
2. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
3. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.

C. Flushometer-Valve Installation:

1. Install flushometer-valve water-supply fitting on each supply to each urinal.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible urinals with handle mounted on open side of compartment.

D. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Joint Sealing:

1. Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to urinal color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match urinals.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to urinals, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust urinals and controls. Replace damaged and malfunctioning urinals, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

3.5 CLEANING AND PROTECTION

A. Clean urinals and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed urinals and fittings.

C. Do not allow use of urinals for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213.16

SECTION 224216.13 - COMMERCIAL LAVATORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Lavatories.
2. Faucets.
3. Supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

C. Pipe, pipe or plumbing fittings, fixtures, solder and flux installed in a system providing water for human consumption shall comply with lead free requirements of California Health and Safety Code Section 116875. Provide submittal information for products third-party certified by an approved laboratory as complying with California Health and Safety Code Section 116875.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

1.7 QUALITY ASSURANCE

A. California Health and Safety Code Compliance: For products covered under the scope of HSC 116875 for potable water service. Products for potable water service shall be third-party certified by an approved laboratory as complying with California Health and Safety Code Section 116875.

PART 2 - PRODUCTS

2.1 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

A. Lavatory: Vitreous china, wall mounted, with back.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following, or equal:

a. American Standard America.

2. Fixture:

a. Standard: ASME A112.19.2/CSA B45.1.
b. Type: For wall hanging.
c. Faucet-Hole Punching: Three holes, 4-inch centers.
d. Faucet-Hole Location: Top.
e. Color: White.
f. Mounting Material: Chair carrier.

3. Faucet: Refer to article, "Solid-Brass, Manually Operated Faucets".
4. Support: Type II, concealed-arm lavatory carrier. Include rectangular, steel uprights.
5. Lavatory Mounting Height: Refer to Drawings.

2.2 SOLID-BRASS, MANUALLY OPERATED FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Lavatory Faucets: Manual-type, single-control mixing two-handle mixing, commercial, solid-brass valve.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following, or equal:

a. American Standard America.

2. Standard: ASME A112.18.1/CSA B125.1.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
4. Body Type: Centerset.
5. Body Material: Commercial, solid brass.
6. Finish: Polished chrome plate.
7. Maximum Flow Rate: 0.5 gpm.
8. Maximum Flow: 0.25 gal. per metering cycle.
9. Mounting Type: Deck, exposed.
10. Valve Handle(s): Push button.
11. Spout: Rigid type.
12. Spout Outlet: Aerator.
13. Operation: Compression, manual.
14. Drain: Not part of faucet.

2.3 SUPPORTS

A. Type II Lavatory Carrier:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Josam Company.
b. MIFAB, Inc.
c. Wade Drains.
d. Watts; a Watts Water Technologies company.
e. Zurn Industries, LLC.

2. Standard: ASME A112.6.1M.

2.4 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with female threaded inlet connection matching supply piping.

E. Operation: Loose key.

F. Risers:

1. NPS 1/2.

2. ASME A112.18.6, braided- or corrugated-stainless-steel, flexible hose riser, integral to faucet.

2.5 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2 by NPS 1-1/4.
2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated, brass or steel wall flange.
3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless-steel tube to wall; and stainless-steel wall flange.

2.6 SUPPORTS

A. Type II Lavatory Carrier:

1. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.

B. Examine walls for suitable conditions where lavatories will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install lavatories level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-mounted lavatories.

C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.

D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.

B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed lavatories and fittings.

D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.13

This page intentionally left blank.

SECTION 22 42 16.16 - COMMERCIAL SINKS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Service basins.
2. Stainless steel sinks.
3. Sink faucets.
4. Continuous-feed disposers.
5. Supply fittings.
6. Waste fittings.

1.2 SUBMITTALS

A. Product Data: For each type of product.

B. Pipe, pipe or plumbing fittings, fixtures, solder and flux installed in a system providing water for human consumption shall comply with lead free requirements of California Health and Safety Code Section 116875. Provide submittal information for products third-party certified by an approved laboratory as complying with California Health and Safety Code Section 116875.

C. Maintenance data.

1.3 QUALITY ASSURANCE

A. California Health and Safety Code Compliance: For products covered under the scope of HSC 116875 for potable water service. Products for potable water service shall be third-party certified by an approved laboratory as complying with California Health and Safety Code Section 116875.

PART 2 - PRODUCTS

2.1 SERVICE BASINS

A. Service Basins: Terrazzo, floor mounted.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. Fiat Products.
      b. Florestone Products Co., Inc.
   2. Fixture:
      a. Standard: IAPMO PS 99.
      b. Shape: Radial front.
      c. Height: 12 inches with dropped front.

d. Tiling Flange: On two sides.
e. Rim Guard: On front top surfaces.
f. Drain: Grid with NPS 3 outlet.

3. Mounting: On floor and flush to wall.
4. Faucet: F-1. Refer to article, Sink Faucets.

2.2 STAINLESS STEEL SINKS

A. Kitchen Sinks: One bowl, counter mounted, stainless steel.
1. Stainless-Steel Sinks:
a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following, or equal:
1) Elkay Manufacturing Co.
2) Just Manufacturing.
2. Fixture:
a. Standard: ASME A112.19.3/CSA B45.4 for stainless-steel sinks.
b. Metal Thickness: [0.038 inch] [0.050 inch] <Insert dimension>.
c. Bowl:
1) Dimensions: Refer to schedules on Drawings.
d. Faucet: F-2. Refer to article, Sink Faucets.
3. Supply Fittings: Comply with requirements in "Supply Fittings" Article.
4. Waste Fittings: Comply with requirements in "Waste Fittings" Article, except include continuous waste for multibowl sinks.

2.3 SINK FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet-spout materials that will be in contact with potable water.

B. Sink Faucets : Manual type, two-lever-handle mixing valve.

1. Commercial, Solid-Brass Faucets (Service Basins) F-1:
a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1) Speakman Company.
2) T & S Brass and Bronze Works, Inc.
b. Standard: ASME A112.18.1/CSA B125.1.
c. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
d. Body Type: Widespread.
e. Body Material: Commercial, solid brass.
f. Finish: Chrome plated.
g. Maximum Flow Rate: 2.2 gpm.
h. Handle(s): Lever.
i. Mounting Type: Back/wall, exposed.
j. Spout Type: Rigid, solid brass with wall brace and pail hook.
k. Vacuum Breaker: Required for hose outlet.
l. Spout Outlet: Aerator.
2. Commercial, Solid-Brass Faucets (Stainless Steel Sinks) F-2.

a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1) American Standard America.

3. Standard: ASME A112.18.1/CSA B125.1.
4. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
5. Finish: Polished chrome plate.
6. Mixing Valve: Two-lever handle.
7. Centers: 8 inches.
8. Mounting: Deck, exposed.
9. Handle(s): Wrist blade, 4 inches.
10. Spout Type: Rigid/swing gooseneck.
11. Spout Outlet: Aerator.
12. Drain: Not a part of faucet.

2.4 CONTINUOUS-FEED DISPOSERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following, or equal:
1. KitchenAid; a division of Whirlpool Corporation.

B. Standards: ASSE 1008 and UL 430, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. General: Include reset button; wall switch; corrosion-resistant chamber with jam-resistant, cutlery- or stainless-steel grinder or shredder; NPS 1-1/2 outlet; quick-mounting, stainless-steel sink flange; antisplash guard; and combination cover/stopper.

D. Model: Sound-insulated chamber.

E. Motor: 115-V ac, 1725 rpm, with overload protection.

2.5 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with female threaded inlet connection matching supply piping.

E. Operation: Loose key.

F. Risers:

1. NPS 1/2

2. Chrome-plated, rigid-copper pipe.

2.6 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2.
2. Material: Chrome-plated, two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated brass or steel wall flange.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.

B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install sinks level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-hung sinks.

C. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.

D. Set floor-mounted sinks in leveling bed of cement grout.

E. Install water-supply piping with stop on each supply to each sink faucet.

1. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523 "General-Duty for Plumbing Piping."
2. Install stops in locations where they can be easily reached for operation.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

I. Install disposer in outlet of each sink indicated to have a disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.

3.3 CONNECTIONS

A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.

B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed sinks and fittings.

D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.16

This page intentionally left blank.

SECTION 224716 - PRESSURE WATER COOLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes pressure water coolers and related components.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of pressure water cooler.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals:

1. Product Data: For water consumption.

C. Shop Drawings: Include diagrams for power, signal, and control wiring.

D. Pipe, pipe or plumbing fittings, fixtures, solder and flux installed in a system providing water for human consumption shall comply with lead free requirements of California Health and Safety Code Section 116875. Provide submittal information for products third-party certified by an approved laboratory as complying with California Health and Safety Code Section 116875.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For pressure water coolers to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filter Cartridges: One for each installed unit.

1.6 QUALITY ASSURANCE

A. California Health and Safety Code Compliance: HSC 116875 for pressure water coolers. Pressure water coolers shall be third-party certified by an approved laboratory as complying with California Health and Safety Code Section 116875.

PART 2 - PRODUCTS

2.1 PRESSURE WATER COOLERS

A. Pressure Water Coolers: Flush to wall.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following, or equal:

    a. Elkay Manufacturing Co.
    b. Halsey Taylor.

2. Standards:

    a. Comply with NSF 61 Annex G.
    b. Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.

3. Cabinet: All stainless steel.
4. Receptor(s):

    a. Number: Two.
    b. Material: Stainless steel.
    c. Shape: Rounded front.
    d. Bubbler: One for each receptor, with adjustable stream regulator.

5. Drain: Grid type with NPS 1-1/4 tailpiece.
6. Bubbler: One for each receptor, with adjustable stream regulator, located on deck.
7. Control: Push button.
8. Drain: Grid with NPS 1-1/4 tailpiece.
9. Supply: NPS 3/8 with shutoff valve.
10. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 brass P-trap.
11. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards, with capacity sized for unit peak flow rate.
12. Cooling System: Electric, with precooler, hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.

    a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

13. Capacities and Characteristics:

    a. Cooled Water: 8 gph.

b. Ambient-Air Temperature: 90 deg F.
c. Inlet-Water Temperature: 80 deg F.
d. Cooled-Water Temperature: 50 deg F.

2.2 SUPPORTS

A. Refer to schedule on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.

B. Examine walls and floors for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.

B. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.

C. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball or gate valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 220523 “General-Duty Valves for Plumbing Piping.”

D. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

E. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

F. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Install ball or gate shutoff valve on water supply to each fixture. Comply with valve requirements specified in Section 220523 “General-Duty Valves for Plumbing Piping.”

D. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

B. Adjust pressure water-cooler temperature settings.

3.5 CLEANING

A. After installing fixture, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

C. Provide protective covering for installed fixtures.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224716

SECTION 23 00 50 – COMMON WORK RESULTS FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. General requirements applicable to all Division 23 Sections.

1.2 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. This Section is a part of each Division 23 Section.

1.3 ADDITIONAL REQUIREMENTS

A. Furnish and install incidental work not shown or specified necessary to provide a complete and workable system.

B. Make all temporary connections required to maintain services, including adequate heat and cooling, during the course of the Contract without additional cost to Owner. Notify Owner seven days in advance before disrupting services.

C. Provide for adjustments or modifications to fan and motor sheaves, belts, damper linkages, and other components as required to achieve specified air balance at no additional cost to Owner.

1.4 REFERENCES AND STANDARDS

A. Where material or equipment is specified to conform to referenced standards, it shall be assumed that the most recent edition of the standard in effect at the time of bid shall be used.

1. AABC - Associated Air Balance Council
2. AFBMA - Anti Friction Bearing Manufacturer's Association
3. AMCA - Air Moving and Control Association Inc.
    a. Standard 210 - Laboratory Methods of Testing Fans
4. ANSI - American National Standards Institute
5. ARI - Air-Conditioning and Refrigeration Institute
6. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers
7. ASME - American Society of Mechanical Engineers
8. ASTM - American Society for Testing and Materials
9. CCR - California Code of Regulations
    a. Title 8 - Division of Industrial Safety, Subchapter 7; General Industry Safety Orders, Articles 31 through 36
10. CSA – Canadian Standards Association International

11. CSFM - California State Fire Marshal
12. NCPWB - National Certified Pipe Welding Bureau
13. NIST - National Institute of Standards and Technology
14. NEMA - National Electrical Manufacturers' Association
15. NFPA - National Fire Protection Association
16. OSHA - Occupational Safety and Health Act
17. SMACNA - Duct Manuals
18. UL - Underwriters' Laboratories, Inc.

B. Requirements of Regulatory Agencies:

1. The publications listed below form part of this specification; comply with provisions of these publications except as otherwise shown or specified.
2. [Code editions shall be as noted on Drawings, as adopted by the California Division of the State Architect (DSA).]

   a. California Building Code.
   b. California Electrical Code.
   c. California Energy Code.
   d. California Fire Code.
   e. California Green Building Standards Code.
   f. California Mechanical Code.
   g. California Plumbing Code.
   h. California Code of Regulations, Title 24.
   i. California Health and Safety Code.
   j. CAL-OSHA.
   k. California State Fire Marshal, Title 19 CCR.
   l. National Fire Protection Association.
   m. Occupational Safety and Health Administration.
   n. Other applicable state laws.

3. Nothing in Drawings or specifications shall be construed to permit work not conforming to these codes, or to requirements of authorities having jurisdiction. It is not the intent of Drawings or specifications to repeat requirements of codes except where necessary for clarity.

1.5 DRAWINGS

A. Examine Contract Documents prior to bidding of work and report discrepancies in writing to Architect.

B. Drawings showing location of equipment and materials are diagrammatic and job conditions will not always permit installation in location shown. The HVAC Drawings show general arrangement of equipment and materials, etc., and shall be followed as closely as existing conditions, actual building construction, and work of other trades permit.

1. Architectural and Structural Drawings shall be considered part of the Work. These Drawings furnish Contractor with information relating to design and construction of the Project. Architectural Drawings take precedence over HVAC Drawings.
2. Because of the small scale of HVAC Drawings, not all offsets, fittings, and accessories required are shown. Investigate structural and finish conditions affecting the Work and arrange Work accordingly. Provide offsets, fittings, and accessories required to meet conditions. Inform Architect immediately when job conditions do not permit installation of equipment and materials in the locations shown. Obtain the Architects approval prior to relocation of equipment and materials.

3. Relocate equipment and materials installed without prior approval of the Architect. Remove and relocate equipment and materials at Contactors' expense upon Architects' direction.
4. Minor changes in locations of equipment, piping, ducts, etc., from locations shown shall be made when directed by the Architect at no additional cost to the Owner providing such change is ordered before such items of work, or work directly connected to same are installed and providing no additional material is required.

C. Execute work mentioned in the Specifications and not shown on the Drawings, or vice versa, the same as if specifically mentioned or shown in both.

1.6 FEES AND PERMITS

A. Obtain and pay for permits and service required in installation of the Work. Arrange for required inspections and secure approvals from authorities having jurisdiction. Comply with requirements of Division 01.

B. Arrange for utility connections and pay charges incurred, including excess service charges.

1.7 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Submittals shall be submitted in accordance with the requirements of Section 01 33 00, Submittal Procedures.

2. Closeout Submittals shall be submitted in accordance with the requirements of Section 01 77 00, Closeout Procedures.

B. Coordination:

1. General:

a. Coordinate HVAC Work with trades covered in other Specifications Sections to provide a complete, operable and sanitary installation of the highest quality workmanship.

2. Have fire damper and fire smoke damper installation instructions available at Project site during construction for use by Project Inspector.
3. Electrical Coordination:

a. Refer to Section 26 05 30, "Conduit and Wire,", for service voltage and power feed wiring for equipment specified under this section. Contractor has full responsibility for the following items of work:

1) Review the Electrical Drawings and Division 26 Specifications to verify that electrical services provided are adequate and compatible with equipment requirements.
2) If additional electrical services are required above that indicated on Electrical Drawings and in Division 26, such as more control interlock conductors, larger feeder, or separate 120 volt control power source, include cost to furnish and install additional electrical services as part of the bid.
3) Prior to proceeding with installation of additional electrical work, submit detailed drawings indicating exact scope of additional electrical work.

4. Mechanical Coordination:

a. Arrange for pipe spaces, chases, slots and openings in building structure during progress of construction, to accommodate mechanical system installation.
b. Coordinate installation of supporting devices. Set sleeves in poured-in-place concrete and other structural components during construction.
c. Coordinate requirements for access panels and doors for mechanical items requiring access where concealed behind finished surfaces.
d. Coordinate with other trades equipment locations, pipe, duct and conduit runs, electrical outlets and fixtures, air inlets and outlets, and structural and architectural features. Provide information on location of piping and seismic bracing to other trades as required for a completely coordinated project.

1.8 SUBMITTALS - GENERAL

A. Submittal packages may be submitted via email as PDF electronic files, or as printed packages. PDFs shall be legible at actual size (100 percent). Provide seven copies of printed submittal packages.

B. Provide submittal of materials proposed for use as part of this Project. Product names in Specifications and on Drawings are used as standards of quality. Furnish standard items on specified equipment at no extra cost to the Contract regardless of disposition of submittal data. Other materials or methods shall not be used unless approved in writing by Architect. Architect's review will be required even though "or equal" or synonymous terms are used. Refer to Division 01 for complete instructions.

1. Partial or incomplete submittals will not be considered.
2. Quantities are Contractor's responsibility and will not be reviewed.
3. Provide materials of the same brand or manufacturer for each class of equipment or material.
4. Identify each item by manufacturer, brand, trade name, number, size, rating, or other data necessary to properly identify and review materials and equipment. Words "as specified" are not sufficient identification.
5. Identify each submittal item by reference to items' Specification Section number and paragraph, by Drawing and detail number, and by unit tag number.
6. Organize submittals in same sequence as in Specification Sections.
7. Show physical arrangement, construction details, finishes, materials used in fabrications, provisions for piping entrance, access requirements for installation and maintenance, physical size, mechanical characteristics, foundation and support details, and weight.

    a. Submit Shop Drawings, performance curves, and other pertinent data, showing size and capacity of proposed materials.
    b. Specifically indicate, by drawn detail or note, that equipment complies with each specifically stated requirement of Contract Documents.
    c. Drawings shall be drawn to scale and dimensioned (except schematic diagrams). Drawings may be prepared by vendor but must be submitted as instruments of Contractor, thoroughly checked and signed by Contractor before submission to Architect for review.
    d. Catalog cuts and published material may be included with supplemental scaled drawings.

C. Review of submittals will be only for general conformance with design concept and general compliance with information given in Contract Documents. Review will not include quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with work of other trades, or construction safety precautions, which are sole responsibility of Contractor. Review of a component of an assembly does not indicate acceptance of an assembly. Deviations from Contract Documents not clearly identified by Contractor are Contractor's responsibility and will not be reviewed by Architect.

D. Within reasonable time after award of contract and in ample time to avoid delay of construction, submit to Architect shop drawings or submittals on all items of equipment and materials provided. Provide submittal as a complete package.

1. Shop drawings and submittals shall include Specification Section, Paragraph number, and Drawing unit symbol or detail number for reference. Organize submittals into booklets for each Specification section and submit in loose-leaf binders with index. Deviations from the Contract Documents shall be prominently displayed in the front of the submittal package and referenced to the applicable Contract requirement.

E. Furnish to the Project Inspector complete installation instructions on material and equipment before starting installation.

1.9 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for plumbing systems materials and products.

B. Shop Drawings.

C. Provide product data for insulation products, including insulation, insulation facings, jackets, adhesives, sealants, and coatings, indicating compliance with requirement that these products contain less than 0.1 percent (by mass) polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations.

D. Sustainable Design Submittals:

1. Product Data: For adhesives and sealants, documentation of compliance including printed statement of VOC content and chemical components.

1.10 INFORMATIONAL SUBMITTALS

A. Provide coordinated layouts for HVAC Ductwork systems, in accordance with Specification Section 23 31 13, “Metal Ducts.”

B. Provide evidence of equipment certification to California Energy Code Section 110.1 or 110.2, if not providing Electrically Commutated motors for HVAC fans sized below 1 hp and above 1/12 hp.

1.11 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Refer to Section 01 78 23, Operation and Maintenance Data, for complete instructions. Requirements given below are in addition to or are intended to amplify Division 01 requirements. In case of conflict between requirements given in this Section and those of Division 01, Division 01 requirements shall apply.
2. Furnish three complete sets of Operation and Maintenance Manual bound in hardboard binder, and one compact disc containing complete Operation and Maintenance Manual in searchable PDF format. Provide Table of Contents. Provide index tabs for each piece of equipment in binder and disc. Begin compiling data upon approval of submittals.

a. Sets shall incorporate the following:

1) Product Data.
2) Shop Drawings.
3) Record Drawings.
4) Service telephone number, address and contact person for each category of equipment or system.
5) Complete operating instructions for each item of heating, ventilating and air conditioning equipment.
6) Copies of guarantees/warrantees for each item of equipment or systems.
7) Test data and system balancing reports.
8) Typewritten maintenance instructions for each item of equipment listing lubricants to be used, frequency of lubrication, inspections required, adjustment, etc.
9) Manufacturers' bulletins with parts numbers, instructions, etc., for each item of equipment.
10) Temperature control diagrams and literature.
11) [A complete list or schedule of all scheduled valves giving the number of the valve, location and the rooms or area controlled by the valve. Identify each valve with a permanently attached metal tag stamped with number to match schedule. Post list in frame under plastic on wall in mechanical room or where directed by Architect.]
12) Check test and start reports for each piece of mechanical equipment provided as part of the Work.
13) Commissioning and Preliminary Operation Tests required as part of the Work.

3. Post service telephone numbers and addresses in an appropriate place designated by Architect.

B. Record Drawings:

1. Refer to Section 01 78 39, Project Record Documents, for requirements governing Work specified herein.
2. Upon completion of the Work, deliver to Architect the following:

a. Originals of drawings showing the Work exactly as installed.
b. One complete set of reproducible drawings showing the Work exactly as installed.
c. One compact disc with complete set of drawings in PDF format showing the Work exactly as installed.
d. Provide Contractor’s signature, verifying accuracy of record drawings.
e. Obtain the signature of the Project Inspector of Record for Record Drawings.

1.12 SUBSTITUTIONS

A. Refer to Section 01 25 00, Substitution Procedures, for complete instructions. Requirements given below are in addition to or are intended to amplify Division 01 requirements. In case of conflict between requirements given in this Section and those of Division 01, Division 01 requirements shall apply.

B. It is the responsibility of Contractor to assume costs incurred because of additional work and or changes required to incorporate proposed substitute into the Project. Refer to Division 01 for complete instructions.

C. Substitutions will be interpreted to be manufacturers other than those specifically listed in the Contract Documents by brand name, model, or catalog number.

D. Only one request for substitution will be considered for each item of equipment or material.

E. Substitution requests shall include the following:

1. Reason for substitution request.
2. Complete submittal information as described herein; see “Submittals.”
3. Coordinated scale layout drawings depicting position of substituted equipment in relation to other work, with required clearances for operation, maintenance and replacement.
4. List optional features required for substituted equipment to meet functional requirements of the system as indicated in Contract Documents.
5. Explanation of impact on connected utilities.
6. Explanation of impact on structural supports.

F. Installation of reviewed substitution is Contractors’ responsibility. Any mechanical, electrical, structural, or other changes required for installation of substituted equipment or material must be made by Contractor without additional cost to Owner. Review by Architect of substituted equipment or material, will not waive these requirements.

G. Contractor may be required to compensate Architect for costs related to substituted equipment or material.

1.13 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of HVAC systems products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Contractor's Qualifications: Firm with at least 5 years of successful installation experience on projects with HVAC systems work similar to that required for this Project.

C. Comply with applicable portions of California Mechanical Code pertaining to selection and installation of HVAC materials and products.

D. All materials and products shall be new.

1.14 DELIVERY, STORAGE, AND HANDLING

A. Protect equipment and materials delivered to Project site from weather, humidity and temperature variations, dirt, dust and other contaminants.

1.15 FIELD CONDITIONS

A. Contractor shall visit Project site and examine existing conditions in order to become familiar with Project scope. Verify dimensions shown on Drawings at Project site. Bring discrepancies to the attention of Architect. Failure to examine Project site shall not constitute basis for claims for additional work because of lack of knowledge or location of hidden conditions that affect Project scope.

B. Information on Drawings relative to existing conditions is approximate. Deviations from Drawings necessary during progress of construction to conform to actual conditions shall be approved by the Architect and shall be made without additional cost to the Owner. The Contractor shall be held responsible for damage caused to existing services. Promptly notify the Architect if services are found which are not shown on Drawings.

1.16 WARRANTY

A. Refer to Division 01 for warranty requirements, including effective date of warranty. Refer to specific items of equipment specified herein for warranty duration if different from that specified in Division 01.

B. Repair or replace defective work, material, or part that appears within the warranty period, including damage caused by leaks.

C. On failure to comply with warranty requirements within a reasonable length of time after notification is given, Architect/Owner shall have repairs made at Contractor's expense.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials or equipment of the same type shall be of the same brand wherever possible. All materials shall be new and in first class condition.

B. All sizes, capacities, and efficiency ratings shown are minimum, except that gas capacity is maximum available.

C. Refer to Division 22 10 00 and 23 80 00 for specific system piping materials.

2.2 MATERIALS

A. No material installed as part of this Work shall contain asbestos.

B. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).

C. California Green Building Code Compliance:

1. HVAC and refrigeration equipment shall not contain CFCs.
2. HVAC and refrigeration equipment shall not contain Halons.

2.3 MOTOR STARTERS

A. Square D, Allen Bradley, or equal, in NEMA Type 1 enclosure, unless otherwise specified or required. Minimum starter size shall be Size 1. Provide NEMA 3R enclosure where exposed to outdoors.

B. Provide magnetic motor starters for all equipment provided under the Mechanical Work. Starters shall be non-combination type. Provide part winding or reduced voltage start motors where shown or as hereinafter specified. Minimum size starter shall be Size 1.

1. All starters shall have the following:

a. Cover mounted hand-off-automatic switch. Starters installed exposed in occupied spaces shall have key operated HOA switch.
b. Ambient compensated thermal overload.
c. Fused control transformer (for 120 or 24 volt service).

d. Pilot lights, integral with the starters. Starters located outdoors shall be in NEMA IIIR enclosures.

2. Where three phase motors are provided for two-speed operation, provide two speed motor starters.
3. Starters for single-phase motors shall have thermal overloads. NEMA I enclosure for starters located indoors, NEMA IIIR enclosure for starters located outdoors.
4. Provide OSHA label indicating the device starts automatically.

2.4 VALVE BOXES

A. General:

1. Where several valves or other equipment are grouped together, provide larger boxes of rectangular "vault" type adequately sized for condition and similar in construction to those specified above.
2. Provide valve box extensions as required to set bottom of valve box tight up to top of piping in which valve is installed.
3. Provide a tee handle wrench for each size, Alhambra Foundry Co. #A-3008, or equal.

B. Valve Boxes in Traffic Areas: Provide Christy No. G5 traffic valve box, Brooks, or approved equal, 10-3/8 inches inside diameter with extensions to suit conditions, with cast iron locking cover. Provide Owner with set of special wrenches or tools as required for operation of valves.

C. Valve Boxes in Non-Traffic Areas: Provide Christy No. F22, Brooks, or approved equal, 8 inches inside diameter by 30 inches long, with cast iron locking cover. Provide Owner with set of special wrenches or tools as required for operation of valves. Cut bottom of plastic body for operation of valves.

D. Valve Box (Rectangular Vault Type): Precast concrete or cast iron with cast iron locking type covers lettered to suit service – Brooks No. 3-TL, Christy No. B3, Fraser No. 3, Alhambra A-3004 or A-3005, Alhambra E-2202, or E-2702, or approved equal, with extension to suit conditions.

2.5 ACCESS DOORS

A. Where floors, walls, or ceilings must be penetrated for access to mechanical equipment, provide access doors, 14 inch by 14 inch minimum size in usable opening. Where entrance of a serviceman may be required, provide 20 inch by 30 inch minimum usable opening. Locate access doors/panels for non-obstructed and easy reach.

1. All access doors less than 7'-0" above floors and exposed to public access shall have keyed locks.

B. Access doors shall match those supplied in Division 08 in all respects, except as noted herein.

C. Provide stainless steel access doors for use in toilet rooms, shower rooms, kitchens and other damp areas. Provide steel access doors with prime coat of baked-on paint for all other areas.

D. Where panels are located on ducts or plenums, provide neoprene gaskets to prevent air leakage, and use frames to set door out to flush with insulation.

E. Provide insulated doors where located in internally insulated ducts or casings.

F. Do not locate access doors in highly visible public areas such as lobbies, waiting areas, and primary entrance areas. Coordinate with the Architect when access is required in these areas.

G. Where specific information or details relating to access panels different from the above is shown or given on the Drawings or other Divisions of work, then that information shall supersede this specification.

H. Manufacturers: Subject to compliance with requirements, available manufacturers offering products which may be incorporated into the Work include Milcor, Karp, Nystrom, or Cesco, equal to the following:

1. Milcor

a. Style K (plaster).
b. Style DW (gypsum board).
c. Style M (Masonry).
d. Style "Fire Rated" where required.

PART 3 - EXECUTION

3.1 FRAMING, CUTTING AND PATCHING

A. Special framing, recesses, chases and backing for Work of this Section, unless otherwise specified, are covered under other Specification Sections.

B. Contractor is responsible for placement of pipe sleeves, hangers, inserts, supports, and location of openings for the Work.

3.2 ELECTRICAL REQUIREMENTS

A. Provide adequate working space around electrical equipment in compliance with the California Electrical Code. Coordinate the Mechanical Work with the Electrical Work to comply.

B. Furnish necessary control diagrams and instructions for the controls. Before permitting operation of any equipment which is furnished, installed, or modified under this Section, review all associated electrical work, including overload protection devices, and assume complete responsibility for the correctness of the electrical connections and protective devices. Motors and control equipment shall conform to the Standards of the National Electrical Manufacturers' Association. All equipment and connections exposed to the weather shall be NEMA IIIR with factory-wired strip heaters in each starter enclosure and temperature control panel where required to inhibit condensation.

C. All line voltage and low voltage wiring and conduit associated with the Temperature Control System are included in this Section. Wiring and conduit shall comply with Division 26.

3.3 PIPING SYSTEM REQUIREMENTS

A. Drawing plans, schematic and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

3.4 INSTALLATION OF PIPING AND DUCT SYSTEMS

A. General:

1. All piping shall be concealed unless shown or otherwise directed. Allow sufficient space for ceiling panel removal.
2. Installation of piping shall be made with appropriate fittings. Bending of piping will not be accepted.
3. Install piping to permit application of insulation and to allow valve servicing.

4. Where piping, conduit, or ductwork is left exposed within a room, the same shall be run true to plumb, horizontal, or intended planes. Where possible, uniform margins are to be maintained between parallel lines and/or adjacent wall, floor, or ceiling surfaces.
5. Horizontal runs of pipes, conduits, or ductwork suspended from ceilings shall provide for a maximum headroom clearance. The clearance shall not be less than 6'-6" without written approval from the Architect.
6. Close ends of pipe immediately after installation. Leave closure in place until removal is necessary for completion of installation.
7. At the time of rough installation, or during storage on the construction site and until final startup of the heating and cooling equipment, all duct and other related air distribution component opening shall be covered with tape, plastic, sheet metal, or other methods acceptable to the enforcing agency.
8. Each piping system shall be thoroughly flushed and proved clean before connection to equipment.
9. Pipe the discharge of each relief valve, air vent, backflow preventer, and similar device to floor sink or drain.
10. Install exposed polished or enameled connections with special care showing no tool marks or threads at fittings.
11. Install horizontal valves with valve stem above horizontal.
12. Use reducing fittings; bushings shall not be allowed. Use eccentric reducing fittings wherever necessary to provide free drainage of lines and passage of air.
13. Verify final equipment locations for roughing-in.
14. Where piping is installed in walls within one inch of the face of stud, provide a 16 gauge sheet metal shield plate on the face of the stud. The shield plate shall extend a minimum of 1-1/2 inches beyond the outside diameter of the pipe.

3.5 ACCESS DOORS

A. Furnish and install access doors wherever required whether shown or not for easy maintenance of mechanical systems; for example, at concealed valves, strainers, traps, cleanouts, dampers, motors, controls, operating equipment, etc. Access doors shall provide for complete removal and replacement of equipment.

3.6 EXPANSION ANCHORS IN HARDENED CONCRETE

A. Refer to Structural Drawings.

3.7 OPERATION OF SYSTEMS

A. Do not operate any mechanical equipment for any purpose, temporary or permanent, until all of the following has been completed:

1. Complete all requirements listed under “Check, Test and Start Requirements.”
2. Ductwork and piping has been properly cleaned. Piping systems shall be flushed and treated prior to operation.
3. Filters, strainers etc. are in place.
4. Bearings have been lubricated, and alignment of rotating equipment has been checked.
5. Equipment has been run under observation, and is operating in a satisfactory manner.

B. Provide test and balance agency with one set of Contract Drawings, Specifications, Addenda, Change orders issued, applicable shop drawings and submittals and temperature control drawings.

C. Operate every fire damper, smoke damper, combination smoke and fire damper under normal operating conditions. Activate smoke detectors as required to operate the damper, stage fan, etc. Provide written confirmation that all systems operate in a satisfactory manner.

3.8 [CHECK, TEST AND START REQUIREMENTS

A. An authorized representative of the equipment manufacturer shall perform check, test and start of each piece of mechanical equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the check test and start of the equipment.

1. As part of the submittal process, provide a copy of each manufacturer's printed startup form to be used.
2. Some items of specified equipment may require that check, test and start of equipment must be performed by the manufacturer, using manufacturer's employees. See specific equipment Articles in these Specifications for this requirement.
3. Provide all personnel, test instruments, and equipment to properly perform the check, test and start work.
4. When work has been completed, provide copies of reports for review, prior to final observation of work.

B. Provide copies of the completed check, test and start report of each item of equipment, bound with the Operation and Maintenance Manual.

C. Upon completion of the work, provide a schedule of planned maintenance for each piece of equipment. Indicate frequency of service, recommended spare parts (including filters and lubricants), and methods for adjustment and alignment of all equipment components. Provide a copy of the schedule with each Operation and Maintenance Manual. Provide a copy of certification from the Owner's representative indicating that they have been properly instructed in maintenance requirements for the equipment installed.]

3.9 PRELIMINARY OPERATIONAL REQUIREMENTS AND TESTS

A. Prior to observation to determine final acceptance, put mechanical systems into service and check that work required for that purpose has been done, including but not limited to the following condensed check list. Provide indexed report to tabulating the results of all work.

1. Refer to Division 22 technical Sections for specific testing requirements.

2. All equipment has been started, checked, lubricated and adjusted in accordance with the manufacturer's recommendations, including modulating power exhausts if present.
3. Correct rotation of motors and ratings of overload heaters are verified.
4. Specified filters are installed and spare filters have been turned over to Owner.
5. All manufacturers' certificates of start-up specified have been delivered to the Owner.
6. All equipment has been cleaned, and damaged painted finishes touched up.
7. Damaged fins on heat exchangers have been combed out.
8. Missing or damaged parts have been replaced.
9. Flushing and chemical treatment of piping systems has been completed and water treatment equipment, where specified, is in operation.
10. Equipment labels, pipe marker labels, ceiling markers and valve tags are installed.
11. Valve tag schedules, corrected control diagrams, sequence of operation lists and start-stop instructions have been posted.
12. Preliminary test and balance work is complete, and reports have been forwarded for review.
13. Automatic control set points are as designated and performance of controls checks out to agree with the sequence of operation.
14. Operation and Maintenance Manuals have been delivered and instructions to the operating personnel have been made.

B. Prior to the observation to determine final acceptance, operate all mechanical systems as required to demonstrate that the installation and performance of these systems conform to the requirements of these specifications.

1. Operate and test all mechanical equipment and systems for a period of at least five consecutive 8 hour days to demonstrate the satisfactory overall operation of the project as a complete unit.
2. [Include operation of heating and air conditioning equipment and systems for a period of not less than two 8 hour days at not less than 90 percent of full specified heating and cooling capacities in tests.]
3. Commence tests after preliminary balancing and adjustments to equipment have been checked. Immediately before starting tests, install air filters and lubricate all running equipment. Notify the Architect at least seven calendar days in advance of starting the above tests.
4. During the test period, make final adjustments and balancing of equipment, systems controls, and circuits so that all are placed in first class operating condition.
5. Where Utility District rebates are applicable, demonstrate that the systems meet the rebate program requirements.

C. Before handing over the system to Owner replace all filters with complete new set of filters.

D. Review of Contractor's Tests:

1. All tests made by the Contractor or manufacturers' representatives are subject to observation and review by the Owner. Provide timely notice prior to start of each test, in order to allow for observation of testing. Upon the completion of all tests, provide a report to confirm that all testing has been successful.

E. Test Logs:

1. Maintain test logs listing the tests on all mechanical systems showing dates, items tested, inspectors' names, remarks on success or failure of the tests.

F. Preliminary Operation:

1. The Owner reserves the right to operate portions of the mechanical system on a preliminary basis without voiding the guarantee.

G. Operational Tests:

1. Before operational tests are performed, demonstrate that all systems and components are complete and fully charged with operating fluid and lubricants.
2. Systems shall be operable and capable of maintaining continuous uninterrupted operation during the operating and demonstration period. After all systems have been completely installed, connections made, and tests completed, operate the systems continuously for a period of five working days during the hours of a normal working day.
3. This period of continuous systems operation may be coordinated with the removal of Volatile Organic Compounds (VOCs) from the building prior to occupancy should the Owner decide to implement such a program.
4. Control systems shall be completely operable with settings properly calibrated and adjusted.
5. Rotating equipment shall be in dynamic balance and alignment.
6. If the system fails to operate continuously during the test period, the deficiencies shall be corrected and the entire test repeated.

H. Pre-Occupancy Building Purge:

1. Prior to occupancy, ventilate the building on 100 percent outside air, 100 percent exhaust for a continuous period determined by a qualified industrial hygienist (engaged by the Contractor) to reduce V.O.C’s prior to occupancy.
2. Submit report by the industrial hygienist verifying satisfactory completion of the pre-occupancy purge.

3.10 CERTIFICATES OF INSTALLATION

A. Contractor shall complete applicable "Certificates of Installation" forms contained in the California Building Energy Efficiency Standards and submit to the authorities having jurisdiction for approval and issuance of final occupancy permit, as described in the California Energy Code.

3.11 ACCEPTANCE REQUIREMENTS

A. Contractor shall complete the applicable Acceptance Requirements for Code Compliance contained in the California Building Energy Efficiency Standards. Refer to T-24 compliance forms on Drawings for systems having Acceptance testing requirements. Contractor shall perform Acceptance tests under the direction of the Commissioning Agent and complete the appropriate "Certificates of Acceptance." Submit certificates to the authorities having jurisdiction for approval and issuance of final occupancy permit. Contractor shall engage certified HERS Rater to verify duct leakage rate for duct systems indicated on T-24 compliance forms on Drawings as requiring duct leakage rate testing. For additional duct leak testing requirements, refer to Section 23 31 13, "Metal Ducts.

3.12 DEMONSTRATION AND TRAINING

A. An authorized representative of the equipment manufacturer shall train Owner-designated personnel in maintenance and adjustment of equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the Owner training for the equipment installed.

1. As part of the submittal process, provide a training agenda outlining major topics and time allowed for each topic.
2. Some items of specified equipment require that training must be performed by the manufacturer, using manufacturer's employees. See specific equipment Articles in these Specifications for this requirement.
3. Contractor shall provide three copies of certification by Contractor that training has been completed, signed by Owner's representative, for inclusion in Operation and Maintenance Manual. Certificates shall include:

    a. Listing of Owner-designated personnel completing training, by name and title.
    b. Name and title of training instructor.
    c. Date(s) of training.
    d. List of topics covered in training sessions.

4. Refer to specific equipment Sections for minimum training period duration for each piece of equipment.

3.13 COMMISSIONING

A. This Project will be commissioned by a third-party Commissioning Agent. In addition to the requirements of Division 23 Specifications, comply with the requirements of Section 01 91 13, "General Commissioning Requirements."

END OF SECTION 23 00 50

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 SUBMITTALS

A. Provide evidence of equipment certification to California Energy Code Section 110.1 or 110.2, if not providing Electrically Commutated motors for HVAC fans sized below 1 hp and above 1/12 hp.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.
2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.

2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Motors for HVAC exhaust, transfer, and supply fans larger than 1/12 hp and smaller than 1 hp shall be the following:

1. Electrically Commutated motor (EC type): Motor shall be brushless DC type specifically designed for applications with heavy duty ball bearings and electronic commutation. The motor shall be speed controllable down to 20 percent of full speed and 85 percent efficient at all speeds. These motors shall also have the means to adjust motor speed for either balancing or remote control. Exceptions:

   a. Motors in fan-coils and terminal units that operate only when providing heating to the space served.
   b. Motors installed in space conditioning equipment certified under 2013 California Energy Code Section 110.1 or 110.2.

C. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

D. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

E. Motors 1/20 HP and Smaller: Shaded-pole type.

F. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 230513

This page intentionally left blank.

SECTION 230516 - EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Flexible, ball-joint packed expansion joints.
2. Slip-joint, packed expansion joints.
3. Flexible-hose packless expansion joints.
4. Metal-bellows packless expansion joints.
5. Grooved-joint expansion joints.
6. Alignment guides and anchors.
7. Pipe loops and swing connections.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Delegated-Design Submittal: For each anchor and alignment guide, including analysis data, signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and swing connections.
2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
3. Alignment Guide Details: Detail field assembly and attachment to building structure.
4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For expansion joints to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe and Pressure-Vessel Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.

B. Capability: Products to absorb 200 percent of maximum axial movement between anchors.

2.2 PACKED EXPANSION JOINTS

A. Flexible, Ball-Joint Packed Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Advanced Thermal Systems, Inc.
    b. Hyspan Precision Products, Inc.
    c. Mason Industries, Inc.

2. Standards: ASME Boiler and Pressure Vessel Code: Section II, "Materials"; ASME B31.9, "Building Services Piping," for materials and design of pressure-containing parts and bolting.
3. Material: Carbon-steel assembly with asbestos-free composition packing.
4. Design: Provide 360-degree rotation and angular deflection.
5. Minimum Pressure Rating: 250 psig at 400 deg F.
6. Angular Deflection for NPS 6 and Smaller: 30 degree minimum.
7. Angular Deflection for NPS 8 and Larger: 15 degree minimum.

8. End Connections for NPS 2 and Smaller: Threaded.
9. End Connections for NPS 2-1/2 and Larger: Flanged.

B. Slip-Joint Packed Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Adsco Manufacturing LLC.
    b. Advanced Thermal Systems, Inc.
    c. Hyspan Precision Products, Inc.
    d. Mason Industries, Inc.

2. Standard: ASTM F 1007.
3. Material: Carbon steel with asbestos-free PTFE packing.
4. Design: With internal guide and injection ports for repacking under full system pressure. Housing shall be furnished with drain ports and lifting ring. Include drip connection if used for steam piping.
5. Configuration: Single joint Single joint with base and class(es), unless otherwise indicated.
6. End Connections: Flanged or welded ends to match piping system.

2.3 PACKLESS EXPANSION JOINTS

A. Metal, Compensator Packless Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Flex-Hose Co., Inc.
    b. Flexicraft Industries.
    c. Flex-Weld, Inc.
    d. Hyspan Precision Products, Inc.
    e. Mason Industries, Inc.
    f. Metraflex Company (The).

2. Minimum Pressure Rating: 175 psig, unless otherwise indicated.
3. Description: Totally enclosed, externally pressurized, multi-ply bellows isolated from fluid flow by an internal pipe sleeve and external housing.
4. Joint Axial Movement: 2 inches of compression and 1/2 inch of extension.
5. Configuration for Copper Tubing: Multi-ply, phosphor-bronze bellows with copper pipe ends.

    a. End Connections for Copper Tubing NPS 2 and Smaller: threaded.
    b. End Connections for Copper Tubing NPS 2-1/2 to NPS 4: Threaded.

6. Configuration for Steel Piping: Multi-ply, stainless-steel bellows; steel-pipe end connections; and carbon-steel shroud.

    a. End Connections for Steel Pipe NPS 2 and Smaller: Threaded.
    b. End Connections for Steel Pipe NPS 2-1/2 to NPS 4: Flanged.

B. Rubber Union Connector Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Amber/Booth Company, Inc.; a VMC Group Company.
    b. Flex-Hose Co., Inc.
    c. Flexicraft Industries.
    d. General Rubber Corporation.
    e. Mason Industries, Inc.
    f. Proco Products, Inc.
    g. Unaflex.
    h. Unisource Manufacturing, Inc.

2. Material: Twin reinforced-rubber spheres with external restraining cables.

3. Minimum Pressure Rating: 150 psig at 170 deg F, unless otherwise indicated.
4. End Connections for NPS 2 and Smaller: Threaded.

C. Flexible-Hose Packless Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Flex Pression Ltd.
    b. Flex-Hose Co., Inc.
    c. Flexicraft Industries.
    d. Mason Industries, Inc.
    e. Metraflex Company (The).
    f. Unisource Manufacturing, Inc.

2. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose.
3. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.
4. Expansion Joints for Copper Tubing NPS 2 and Smaller: Copper-alloy fittings with threaded end connections.

    a. Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F and 340 psig at 450 deg F ratings.
    b. Bronze hoses and double-braid bronze sheaths with 700 psig at 70 deg F and 500 psig at 450 deg F ratings.

5. Expansion Joints for Copper Tubing NPS 2-1/2 to NPS 4: Copper-alloy fittings with threaded end connections.

    a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F and 225 psig at 450 deg F ratings.

6. Expansion Joints for Steel Piping NPS 2 and Smaller: Carbon-steel fittings with threaded end connections.

    a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 450 psig at 70 deg F and 325 psig at 600 deg F ratings.

7. Expansion Joints for Steel Piping NPS 2-1/2 to NPS 6: Carbon-steel fittings with flanged end connections.

    a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 200 psig at 70 deg F and 145 psig at 600 deg F ratings.

D. Metal-Bellows Packless Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Adsco Manufacturing LLC.
    b. American BOA, Inc.
    c. Badger Industries, Inc.

d. Expansion Joint Systems, Inc.
e. Flex Pression Ltd.
f. Flex-Hose Co., Inc.
g. Flexicraft Industries.
h. Flex-Weld, Inc.
i. Flo Fab inc.
j. Hyspan Precision Products, Inc.
k. Mason Industries, Inc.
l. Metraflex Company (The).
m. Proco Products, Inc.
n. Senior Flexonics Pathway.
o. Tozen Corporation.
p. U.S. Bellows, Inc.
q. Unaflex.
r. Unisource Manufacturing, Inc.
s. Universal Metal Hose.
t. WahlcoMetroflex.

2. Standards: ASTM F 1120 and EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."
3. Type: Circular, corrugated bellows with external tie rods.
4. Minimum Pressure Rating: 175 psig, unless otherwise indicated.
5. Configuration: Single joint, Single joint with base, and double joint with base class(es), unless otherwise indicated.
6. Expansion Joints for Copper Tubing: Single- or multi- ply phosphor-bronze bellows, copper pipe ends, and brass shrouds.

   a. End Connections for Copper Tubing NPS 2 and Smaller: threaded.
   b. End Connections for Copper Tubing NPS 2-1/2 to NPS 4: threaded.
   c. End Connections for Copper Tubing NPS 5 and Larger: Flanged.

7. Expansion Joints for Steel Piping: Single- or multi- ply stainless-steel bellows, steel pipe ends, and carbon-steel shroud.

   a. End Connections for Steel Pipe NPS 2 and Smaller: Threaded.
   b. End Connections for Steel Pipe NPS 2-1/2 and Larger: Flanged.

2.4 GROOVED-JOINT EXPANSION JOINTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   1. Anvil International.
   2. Shurjoint Piping Products.
   3. Victaulic Company.

B. Description: Factory-assembled expansion joint made of several grooved-end pipe nipples, couplings, and grooved joints.

C. Standard: AWWA C606, for grooved joints.

D. Nipples: Galvanized, ASTM A 53/A 53M, Schedule 40, Type E or S, steel pipe with grooved ends.

E. Couplings: Five, flexible type for steel-pipe dimensions. Include ferrous housing sections, Buna-N gasket suitable for diluted acid, alkaline fluids, and cold and hot water or ethylene-propylene-diene terpolymer rubber gasket suitable for cold and hot water, and bolts and nuts.

2.5 ALIGNMENT GUIDES AND ANCHORS

A. Alignment Guides:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Adsco Manufacturing LLC.
    b. Advanced Thermal Systems, Inc.
    c. Flex-Hose Co., Inc.
    d. Flexicraft Industries.
    e. Flex-Weld, Inc.
    f. Hyspan Precision Products, Inc.
    g. Mason Industries, Inc.
    h. Metraflex Company (The).
    i. Senior Flexonics Pathway.
    j. U.S. Bellows, Inc.
    k. Unisource Manufacturing, Inc.

2. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding slider for bolting to pipe.

B. Anchor Materials:

1. Steel Shapes and Plates: ASTM A 36/A 36M.
2. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.
3. Washers: ASTM F 844, steel, plain, flat washers.
4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.

    a. Stud: Threaded, zinc-coated carbon steel.
    b. Expansion Plug: Zinc-coated steel.
    c. Washer and Nut: Zinc-coated steel.

PART 3 - EXECUTION

3.1 EXPANSION JOINT INSTALLATION

A. Install expansion joints of sizes matching sizes of piping in which they are installed.

B. Install packed-type expansion joints with packing suitable for fluid service.

C. Install metal-bellows expansion joints according to EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."

D. Install rubber packless expansion joints according to FSA-PSJ-703.

E. Install grooved-joint expansion joints to grooved-end steel piping.

3.2 PIPE LOOP AND SWING CONNECTION INSTALLATION

A. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

B. Connect risers and branch connections to mains with at least five pipe fittings, including tee in main.

C. Connect risers and branch connections to terminal units with at least four pipe fittings, including tee in riser.

D. Connect mains and branch connections to terminal units with at least four pipe fittings, including tee in main.

3.3 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION

A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

B. Install two guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.

C. Attach guides to pipe, and secure guides to building structure.

D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

E. Anchor Attachments:

1. Anchor Attachment to Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
2. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24; U bolts bolted to anchor.

F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.

1. Anchor Attachment to Steel Structural Members: Attach by welding.
2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.

G. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

END OF SECTION 230516

This page intentionally left blank.

SECTION 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For sealants, indicating VOC content.
2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. GPT; an EnPro Industries company.

B. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends and integral welded waterstop collar.

C. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Advance Products & Systems, Inc.
2. Airex Manufacturing.
3. CALPICO, Inc.
4. GPT; an EnPro Industries company.
5. Metraflex Company (The).
6. Proco Products, Inc.

B. Description:

1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20-psig.
3. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size.
4. Pressure Plates: Carbon steel.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B 633 of length required to secure pressure plates to sealing elements.

2.3 GROUT

A. Description: Nonshrink, recommended for interior and exterior sealing openings in nonfire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout, seal space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200, “Joint Sealants.”

E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke-Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal-system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls Above Grade:

a. Piping Smaller Than NPS 6: Steel pipe sleeves.
b. Piping NPS 6 and Larger: Steel pipe sleeves.

2. Exterior Concrete Walls Below Grade:

a. Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Steel pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

a. Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Steel pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Interior Partitions:

a. Piping Smaller Than NPS 6: Steel pipe sleeves.
b. Piping NPS 6 and Larger: Galvanized-steel sheet sleeves.

END OF SECTION 230517

SECTION 230518 - ESCUTCHEONS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.3 DEFINITIONS

A. Existing Piping to Remain: Existing piping that is not to be removed and that is not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. BrassCraft Manufacturing Co.; a Masco company.
2. Dearborn Brass.

2.2 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished, chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.

2.3 FLOOR PLATES

A. Split Floor Plates: Steel with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
b. Insulated Piping: One-piece cast brass with polished, chrome-plated finish.
c. Bare Piping in Unfinished Service Spaces: One-piece stamped steel with polished, chrome-plated finish.
d. Bare Piping in Equipment Rooms: One-piece stamped steel with polished, chrome-plated finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: Split floor plate.

3.2 FIELD QUALITY CONTROL

A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION 230518

SECTION 230519 - METERS AND GAGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Liquid-in-glass thermometers.
2. Thermowells.
3. Dial-type pressure gages.
4. Gage attachments.
5. Test plugs.
6. Test-plug kits.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter and gage.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Trerice, H. O. Co.
    b. Weiss Instruments, Inc.
    c. Winters Instruments - U.S.

2. Standard: ASME B40.200.
3. Case: Cast aluminum; 7-inch nominal size unless otherwise indicated.
4. Case Form: Adjustable angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue or red organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Window: Glass.
8. Stem: Aluminum and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.2 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion in piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.3 DIAL-TYPE PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Trerice, H. O. Co.
    b. Watts; a Watts Water Technologies company.
    c. Weiss Instruments, Inc.

d. WIKA Instrument Corporation.
e. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Liquid-filled type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Metal.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.4 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston or porous-metal-type surge-dampening device. Include extension for use on insulated piping.

B. Siphons: Loop-shaped section of stainless-steel pipe with NPS 1/4 or NPS 1/2 pipe threads.

C. Valves: Brass ball, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

2.5 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Peterson Equipment Co., Inc.
2. Trerice, H. O. Co.
3. Watts; a Watts Water Technologies company.
4. Weiss Instruments, Inc.

B. Description: Test-station fitting made for insertion in piping tee fitting.

C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

F. Core Inserts: EPDM self-sealing rubber.

2.6 TEST-PLUG KITS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Peterson Equipment Co., Inc.
2. Trerice, H. O. Co.
3. Watts; a Watts Water Technologies company.
4. Weiss Instruments, Inc.

B. Furnish one test-plug kit(s) containing one thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

C. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.

D. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch- diameter dial and probe. Dial range shall be at least 0 to 200 psig.

E. Carrying Case: Metal or plastic, with formed instrument padding.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending one-third of pipe diameter and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

G. Install valve and snubber in piping for each pressure gage for fluids (except steam).

H. Install test plugs in piping tees.

I. Install permanent indicators on walls or brackets in accessible and readable positions.

J. Install connection fittings in accessible locations for attachment to portable indicators.

K. Install thermometers in the following locations:

1. Inlet and outlet of each hydronic boiler.

L. Install pressure gages in the following locations:

1. Suction and discharge of each pump.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow space for service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

A. After installation, calibrate meters according to manufacturer's written instructions.

B. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each hydronic boiler shall be the following:

1. Industrial-style, liquid-in-glass type.

B. Thermometers at inlet and outlet of each hydronic coil in air-handling units and built-up central systems shall be the following:

1. Industrial-style, liquid-in-glass type.

C. Thermometers at inlets and outlets of each hydronic coil at VAV boxes shall be the following:

1. Test plug with EPDM self-sealing rubber inserts.

D. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Chilled-Water Piping: 0 to 100 deg F.

B. Scale Range for Heating, Hot-Water Piping: 0 to 250 deg F.

3.6 PRESSURE-GAGE SCHEDULE

A. Pressure gages at suction and discharge of each pump shall be the following:

1. Liquid-filled, direct-mounted, metal case.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Chilled-Water Piping: 0 to 100 psi.

B. Scale Range for Heating, Hot-Water Piping: 0 to 100 psi.

END OF SECTION 230519

SECTION 230523 - GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.
3. Iron ball valves.
4. Iron, single-flange butterfly valves.
5. Iron, grooved-end butterfly valves.
6. Bronze swing check valves.
7. Iron swing check valves.
8. Iron swing check valves with closure control.
9. Iron, center-guided check valves.
10. Bronze globe valves.
11. Iron globe valves.
12. Chainwheels.

B. Related Sections:

1. Section 230553 "Identification for HVAC Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. SWP: Steam working pressure.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
1. Protect internal parts against rust and corrosion.

2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to HVAC valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
2. Handwheel: For valves other than quarter-turn types.
3. Handlever: For quarter-turn valves NPS 6 and smaller.
4. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Solder Joint: With sockets according to ASME B16.18.
3. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRASS BALL VALVES

A. Brass Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Crane; Crane Energy Flow Solutions.
b. Jenkins Valves; Crane Energy Flow Solutions.
c. Milwaukee Valve Company.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

2.3 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Apollo Valves; Conbraco Industries, Inc.
b. Crane; Crane Energy Flow Solutions.
c. Hammond Valve.
d. Lance Valves.
e. Milwaukee Valve Company.

f. NIBCO INC.
g. Watts; a Watts Water Technologies company.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

B. Three-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Conbraco Industries, Inc.; Apollo Valves.
b. Hammond Valve.
c. Milwaukee Valve Company.
d. NIBCO INC.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Three piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

2.4 IRON BALL VALVES

A. Class 125, Iron Ball Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. American Valve, Inc.
b. Conbraco Industries, Inc.; Apollo Valves.
c. Kitz Corporation.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-72.
b. CWP Rating: 200 psig.
c. Body Design: Split body.
d. Body Material: ASTM A 126, gray iron.
e. Ends: Flanged.
f. Seats: PTFE or TFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel.
i. Port: Full.

2.5 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 150 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. ABZ Valve and Controls.
b. Conbraco Industries, Inc.; Apollo Valves.
c. Cooper Cameron Valves.
d. Crane Co.; Crane Valve Group; Jenkins Valves.
e. Crane Co.; Crane Valve Group; Stockham Division.
f. DeZurik Water Controls.
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Spence Engineering Company, Inc.
j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 150 psig.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: EPDM.
f. Stem: One- or two-piece stainless steel.
g. Disc: Aluminum bronze.

2.6 DUCTILE-IRON, GROOVED-END BUTTERFLY VALVES

A. Iron, Grooved-End Butterfly Valves, 175 CWP:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Grinnell Mechanical Products.
b. Kennedy Valve Company; a division of McWane, Inc.
c. Shurjoint Piping Products.
d. Tyco Fire Products LP.

e. Victaulic Company.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 175 psig.
c. Body Material: Coated, ductile iron.
d. Stem: Two-piece stainless steel.
e. Disc: Coated, ductile iron.
f. Seal: EPDM.

2.7 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Watts; a Watts Water Technologies company.

2. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 300 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

2.8 IRON SWING CHECK VALVES

A. Class 250, Iron Swing Check Valves with Metal Seats:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Milwaukee Valve Company.
b. NIBCO INC.

2. Description:

a. Standard: MSS SP-71, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 500 psig.
c. NPS 14 to NPS 24, CWP Rating: 300 psig.

d. Body Design: Clear or full waterway.
e. Body Material: ASTM A 126, gray iron with bolted bonnet.
f. Ends: Flanged.
g. Trim: Bronze.
h. Gasket: Asbestos free.

2.9 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Iron Swing Check Valves with Lever- and Spring-Closure Control, Class 125:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Milwaukee Valve Company.
b. NIBCO INC.

2. Description:

a. Standard: MSS SP-71, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Design: Clear or full waterway.
e. Body Material: ASTM A 126, gray iron with bolted bonnet.
f. Ends: Flanged.
g. Trim: Bronze.
h. Gasket: Asbestos free.
i. Closure Control: Factory-installed, exterior lever and spring.

B. Iron Swing Check Valves with Lever and Weight-Closure Control, Class 125:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Milwaukee Valve Company.
b. NIBCO INC.

2. Description:

a. Standard: MSS SP-71, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Design: Clear or full waterway.
e. Body Material: ASTM A 126, gray iron with bolted bonnet.
f. Ends: Flanged.
g. Trim: Bronze.
h. Gasket: Asbestos free.
i. Closure Control: Factory-installed, exterior lever and weight.

1.1 IRON, CENTER-GUIDED CHECK VALVES

A. Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat, Class 125:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Milwaukee Valve Company.
b. NIBCO INC.

2. Description:

a. Standard: MSS SP-125.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Material: ASTM A 126, gray iron.
e. Style: Compact wafer.
f. Seat: Bronze.

2.10 BRONZE GLOBE VALVES

A. Bronze Globe Valves, Class 150:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Crane; Crane Energy Flow Solutions.
b. Hammond Valve.
c. KITZ Corporation.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Watts; a Watts Water Technologies company.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 300 psig.
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: Bronze or PTFE.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

2.11 IRON GLOBE VALVES

A. Iron Globe Valves, Class 250:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Crane; Crane Energy Flow Solutions.
b. Hammond Valve.
c. Jenkins Valves; Crane Energy Flow Solutions.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Stockham; Crane Energy Flow Solutions.
g. Watts; a Watts Water Technologies company.

2. Description:

a. Standard: MSS SP-85, Type I.
b. CWP Rating: 500 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Packing and Gasket: Asbestos free.
g. Operator: Handwheel or chainwheel.

2.12 CHAINWHEELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Babbitt Steam Specialty Co.
2. Roto Hammer Industries.
3. Trumbull Industries.

B. Description: Valve actuation assembly with sprocket rim, brackets, and chain.

1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
2. Attachment: For connection to ball and butterfly valve stems.
3. Sprocket Rim with Chain Guides: Ductile or cast iron, of type and size required for valve.
4. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install chainwheels on operators for ball, butterfly, gate, and globe valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.

F. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Center-Guided Check Valves: In horizontal or vertical position, between flanges.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, or butterfly valves.
2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
3. Throttling Service: Ball or butterfly valves.
4. Pump-Discharge Check Valves:

    a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
    b. NPS 2-1/2 and Larger: Iron swing check valves with lever and weight or with spring or iron, center-guided, metal-seat check valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends.
3. For Steel Piping, NPS 2 and Smaller: Threaded ends.
4. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

5. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.5 CHILLED-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Ball Valves: Two-piece, full port, bronze or brass with stainless-steel trim.
2. Bronze Swing Check Valves: Class 125, bronze disc.
3. Bronze Globe Valves: Class 150, bronze or nonmetallic disc.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron Ball Valves, NPS 2-1/2 to NPS 10: Class 125.
3. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12: 150 CWP, EPDM seat, aluminum-bronze disc.
4. Iron Swing Check Valves: Class 250, metal seats.
5. Iron Globe Valves: Class 250.

3.6 HEATING-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Ball Valves: Three piece, full port, bronze or brass with stainless-steel trim.
2. Bronze Swing Check Valves: Class 150, bronze disc.
3. Bronze Globe Valves: Class 150, bronze or nonmetallic disc.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron Ball Valves, NPS 2-1/2 to NPS 10: Class 150.
3. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12: 150 CWP, EPDM seat, aluminum-bronze disc.
4. Iron, Grooved-End Butterfly Valves, NPS 2-1/2 to NPS 12: 175 CWP.
5. Iron Swing Check Valves: Class 250, metal seats.
6. Iron Globe Valves, NPS 2-1/2 to NPS 12: Class 250.

END OF SECTION 230523

This page intentionally left blank.

SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Equipment supports.

B. Related Sections:

1. Section 05 50 00 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 23 05 16 "Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.
3. Section 23 05 48 "Vibration and Seismic Controls for HVAC" for vibration isolation devices.
4. Section 23 31 13 "Metal Ducts" for duct hangers and supports.

1.2 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to CBC and ASCE/SEI 7, as referenced by the CBC.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

C. All connections and attachments to the building structural systems will require review and approval for structural engineer of record.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Pipe stands.
4. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.6 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. B-line, an Eaton business.
    b. Flex-Strut Inc.
    c. Thomas & Betts Corporation; A Member of the ABB Group.
    d. Unistrut; Part of Atkore International.
    e. Wesanco, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: Electroplated zinc or hot-dipped galvanized.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Carpenter & Paterson, Inc.
2. Clement Support Services.
3. ERICO International Corporation.
4. National Pipe Hanger Corporation.
5. Pipe Shields Inc.
6. Piping Technology & Products, Inc.
7. Rilco Manufacturing Co., Inc.
8. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type, stainless-steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:
1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    b. NPS 4: 12 inches long and 0.06 inch thick.
    c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 09 91 23 "Interior Painting" and Section 09 96 00 "High Performance Coatings."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use copper-plated pipe hangers and stainless-steel attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.

13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.

9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

O. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

Q. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

SECTION 230548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Open-spring isolators.
2. Housed-spring isolators.
3. Housed-restrained-spring isolators.
4. Pipe-riser resilient supports.
5. Resilient pipe guides.
6. Spring hangers.
7. Snubbers.
8. Restraint channel bracings.
9. Restraint cables.
10. Seismic-restraint accessories.
11. Mechanical anchor bolts.
12. Vibration isolation equipment bases.

B. Related Requirements:

1. Section 210548 "Vibration and Seismic Controls for Fire Suppression" for devices for fire-suppression equipment and systems.
2. Section 220548 "Vibration and Seismic Controls for Plumbing" for devices for plumbing equipment and systems.

1.3 DEFINITIONS

A. OSHPD: Office of Statewide Health Planning & Development (for the State of California).

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.

a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by OSHPD.
b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Shop Drawings:

1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.

1. Calculations performed for use in selection of seismic supports, anchorages, and restraints shall utilize criteria indicated in Structural Contract Documents.
2. Supports, anchorage and restraints for piping, ductwork, and equipment shall be an OSHPD pre-approved system such as Tolco, ISAT, Mason, or equal. Pipes, ducts and equipment shall be seismically restrained in accordance with requirements of current edition of California Building Code. System shall have current OPM number and shall meet additional requirements of authority having jurisdiction. Provide supporting documentation required by the reviewing authority and the Architect and Engineer. Provide layout drawings showing piping, ductwork and restraint locations.

a. Bracing of Piping and Equipment: Specifically state how bracing attachment to structure is accomplished. Provide shop drawings indicating seismic restraints, including details of anchorage to building. In-line equipment must be braced independently of piping, and in conformance with applicable building codes. Provide calculations to show that pre-approval numbers have been correctly applied in accordance with general information notes of pre-approval documentation. Gas pipe bracing shall be designed in accordance with California Building Code Section 1615A.1.22 and ASCE 7-10 Section 13.6. Coefficient $I_p = 1.5$ shall be used for gas piping bracing calculations.

3. In lieu of the above or for non-standard installations not covered in the above pre-approved systems, Contractor shall provide layout drawings showing piping, ductwork, and restraint locations, and detail supports, attachments and restraints, and furnish supporting calculations and legible details sealed by a California registered structural engineer, in accordance with 2016 California Building Code
4. Additional Requirements: In addition to the above, conform to all state and local requirements.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any. Refer to Section 23 00 50, “Common Work Results for HVAC Systems for additional requirements.

B. Qualification Data: For professional engineer and testing agency.

C. Welding certificates.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the CBC unless requirements in this Section are more stringent.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPM number from OSHPD showing maximum seismic-restraint ratings. For additional requirements, refer to article, Action Submittals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. See structural documents for wind and seismic restraint loads.

B. Rated strengths, features, and applications shall be as defined in reports by OSHPD or provide calculations, signed and sealed by a qualified structural engineer registered in the State of California.

2.2 OPEN-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators: .

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Kinetics Noise Control, Inc.
    b. Mason Industries, Inc.
    c. Vibration Isolation.
    d. Vibration Mountings & Controls, Inc.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates shall limit floor load to 500 psig.
7. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

2.3 HOUSED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing: .

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Kinetics Noise Control, Inc.
    b. Mason Industries, Inc.
    c. Vibration Isolation.
    d. Vibration Mountings & Controls, Inc.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.

    a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
    b. Top housing with attachment and leveling bolt.

2.4 HOUSED-RESTRAINED-SPRING ISOLATORS

A. Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Ace Mountings Co., Inc.
    b. California Dynamics Corporation.
    c. Isolation Technology, Inc.
    d. Kinetics Noise Control, Inc.
    e. Mason Industries, Inc.
    f. Vibration Eliminator Co., Inc.
    g. Vibration Isolation.
    h. Vibration Mountings & Controls, Inc.

2. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with adjustable snubbers to limit vertical movement.

    a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
    b. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.

3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.5 PIPE-RISER RESILIENT SUPPORT

A. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch-thick neoprene.

1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
2. Maximum Load Per Support: 500 psigon isolation material providing equal isolation in all directions.

2.6 RESILIENT PIPE GUIDES

A. Description: Telescopic arrangement of two steel tubes or post and sleeve arrangement separated by a minimum 1/2-inch-thick neoprene.

1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.7 SPRING HANGERS

A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression: .

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Kinetics Noise Control, Inc.
    b. Mason Industries, Inc.
    c. Vibration Isolation.
    d. Vibration Mountings & Controls, Inc.

2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
9. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

2.8 SNUBBERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Kinetics Noise Control, Inc.
2. Mason Industries, Inc.
3. Novia; A Division of C&P.
4. Vibration Mountings & Controls, Inc.

B. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
3. Maximum 1/4-inch air gap, and minimum 1/4-inch-thick resilient cushion.

2.9 RESTRAINT CHANNEL BRACINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. B-line, an Eaton business.
2. Hilti, Inc.
3. Mason Industries, Inc.
4. Unistrut; Part of Atkore International.

B. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.10 RESTRAINT CABLES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Kinetics Noise Control, Inc.
2. Mason Industries, Inc.
3. Vibration Mountings & Controls, Inc.

B. Restraint Cables: ASTM A 603 galvanized-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.11 SEISMIC-RESTRAINT ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. B-line, an Eaton business.
2. Kinetics Noise Control, Inc.
3. Mason Industries, Inc.
4. TOLCO.

B. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or reinforcing steel angle clamped to hanger rod.

C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.

D. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.12 MECHANICAL ANCHOR BOLTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. B-line, an Eaton business.
2. Hilti, Inc.
3. Kinetics Noise Control, Inc.
4. Mason Industries, Inc.

B. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.13 VIBRATION ISOLATION EQUIPMENT BASES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. California Dynamics Corporation.
2. Kinetics Noise Control, Inc.
3. Mason Industries, Inc.
4. Novia; A Division of C&P.
5. Vibration Eliminator Co., Inc.
6. Vibration Isolation.
7. Vibration Mountings & Controls, Inc.

B. Steel Rails: Factory-fabricated, welded, structural-steel rails.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide rails.

    a. Include supports for suction and discharge elbows for pumps.

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Rails shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

C. Steel Bases: Factory-fabricated, welded, structural-steel bases and rails.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

    a. Include supports for suction and discharge elbows for pumps.

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

D. Concrete Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

    a. Include supports for suction and discharge elbows for pumps.

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
4. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic- and wind-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by OSHPD.

B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."

B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

C. Equipment Restraints:

1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
3. Install seismic-restraint devices using methods approved by OSHPD that provides required submittals for component.

D. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
3. Brace a change of direction longer than 12 feet.

E. Install cables so they do not bend across edges of adjacent equipment or building structure.

F. Install seismic-restraint devices using methods approved by OSHPD that provides required submittals for component.

G. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

H. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

I. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

J. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 232113 "Hydronic Piping" for piping flexible connections.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. Test and adjust restrained-air-spring isolator controls and safeties.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

3.7 VIBRATION ISOLATION EQUIPMENT BASES INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."

END OF SECTION 230548

This page intentionally left blank.

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Duct labels.
5. Stencils.
6. Valve tags.
7. Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Brimar Industries, Inc.

b. Craftmark Pipe Markers.
c. Marking Services, Inc.
d. Seton Identification Products.

2. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
3. Letter Color: White.
4. Background Color: Black.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Brimar Industries, Inc.
b. Craftmark Pipe Markers.
c. Marking Services, Inc.
d. Seton Identification Products.

2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
3. Letter Color: White.
4. Background Color: Black.
5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
8. Fasteners: Stainless-steel rivets or self-tapping screws.
9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Brimar Industries, Inc.
2. Craftmark Pipe Markers.
3. Marking Sevices Inc.
4. National Marker Company.
5. Seton Identification Products.
6. Stranco, Inc.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

C. Letter Color: Red.

D. Background Color: Yellow.

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

H. Fasteners: Stainless-steel rivets or self-tapping screws.

I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

J. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Brimar Industries, Inc.
2. Craftmark Pipe Markers.
3. Marking Sevices Inc.
4. Seton Identification Products.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

2.4 DUCT LABELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Brady Corporation.
2. Brimar Industries, Inc.
3. Carlton Industries, LP.
4. Champion America.
5. Craftmark Pipe Markers.
6. emedco.
7. Kolbi Pipe Marker Co.
8. LEM Products Inc.
9. Marking Sevices Inc.
10. Seton Identification Products.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

C. Letter Color: Black.

D. Background Color: White.

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

H. Fasteners: Stainless-steel rivets or self-tapping screws.

I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

J. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings; also include duct size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.

2.5 STENCILS

A. Stencils for Access Panels and Door Labels, Equipment Labels, and Similar Operational Instructions:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Brimar Industries, Inc.
   b. Carlton Industries, LP.
   c. Champion America.
   d. Craftmark Pipe Markers.
   e. Kolbi Pipe Marker Co.
   f. Marking Sevices Inc.

2. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.
3. Stencil Material: Aluminum.
4. Stencil Paint: Exterior, gloss, acrylic enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
5. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.

2.6 VALVE TAGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Brimar Industries, Inc.
2. Craftmark Pipe Markers.
3. Marking Sevices Inc.
4. Seton Identification Products.

B. Description: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link chain or beaded chain.

C. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.7 WARNING TAGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Brimar Industries, Inc.
2. Craftmark Pipe Markers.
3. Marking Sevices Inc.
4. Seton Identification Products.

B. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Safety-yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Piping Color Coding: Painting of piping is specified in Section 099123 "Interior Painting" and Section 099600 "High-Performance Coatings."

B. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.

2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

D. Pipe Label Color Schedule:

1. Chilled-Water Piping: White letters on a safety-green background.
2. Heating Water Piping: White letters on a safety-green background.
3. Refrigerant Piping: Black letters on a safety-orange background.

3.5 DUCT LABEL INSTALLATION

A. Install plastic-laminated duct labels with permanent adhesive on air ducts in the following color codes:

1. Blue: For cold-air supply ducts.
2. Yellow: For hot-air supply ducts.
3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.

B. Locate labels near points where ducts enter into and exit from concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.6 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

a. Chilled Water: 1-1/2 inches, round.
b. Refrigerant: 1-1/2 inches,round.
c. Hot Water: 1-1/2 inches, round.
d. Gas: 1-1/2 inches, round.

2. Valve-Tag Colors:

a. Toxic and Corrosive Fluids: Black letters on a safety-orange background.
b. Flammable Fluids: Black letters on a safety-yellow background.

c. Combustible Fluids: White letters on a safety-brown background.
d. Potable and Other Water: White letters on a safety-green background.
e. Defined by User: White letters on a safety-purple background, black letters on a safety-white background, white letters on a safety-gray background, and white letters on a safety-black background

3.7 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 230553

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.
b. Variable-air-volume systems.

2. Balancing Hydronic Piping Systems:

a. Constant-flow hydronic systems.
b. Variable-flow hydronic systems.

B. Balancing Domestic Water Piping Systems.

1.2 REFERENCES

A. Associated Air Balance Council (AABC)

1. National Standards for Total System Balance, latest edition.

1.3 DEFINITIONS

A. The intent of this Section is to use the standards pertaining to the TAB specialist engaged to perform the Work of this Contract, with additional requirements specified in this Section. Contract requirements take precedence over corresponding AABC or NEBB standards requirements. Differences in terminology between the Specifications and the specified TAB organization standards do not relieve the TAB entity engaged to perform the Work of this Contract of responsibility from completing the Work as described in the Specifications.

B. Similar Terms: The following table is provided for clarification only:

Similar Terms	
Contract Term	AABC Term
TAB Specialist	TAB Agency
TAB Standard	National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems

TAB Field Supervisor	Test and Balance Engineer

C. AABC: Associated Air Balance Council.

D. TAB: Testing, adjusting, and balancing.

E. TAB Organization: Body governing practices of TAB Specialists.

F. TAB Specialist: An entity engaged to perform TAB Work.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

1. Provide list of similar projects completed by proposed TAB field supervisor.
2. Provide copy of completed TAB report, approved by mechanical engineer of record for a completed project with similar system types and of similar complexity.

B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

1. Submit examinations report with qualifications data.

C. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. Interim Reports. Submit interim reports as specified in Part 3. Include list of system conditions requiring correction and problems not identified in Contract Documents examination report.

E. Certified TAB reports.

1. Provide three printed copies of final TAB report. Provide one electronic file copy in PDF format.

F. Sample report forms.

G. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

a. Instruments to be used for testing and balancing shall have been calibrated within a period of one year, or less if so recommended by instrument manufacturer and be checked for accuracy prior to start of work.

1.5 QUALITY ASSURANCE

A. Independent TAB Specialist Qualifications: Engage a TAB entity certified by AABC or NEBB.

1. The certification shall be maintained for the entire duration of TAB work for this Project. If TAB specialist loses certification during this period, the Contractor shall immediately notify the Architect and submit another TAB specialist for approval. All work specified in this Section and in other related Sections performed by the TAB specialist shall be invalidated if the TAB specialist loses certification, and shall be performed by an approved successor.

B. To secure approval for the proposed TAB specialist, submit information certifying that the TAB specialist is either a first-tier subcontractor engaged and paid by the Contractor, or is engaged and paid directly by the Owner. TAB specialist shall not be affiliated with any other entity participating in Work of this Contract, including design, furnishing equipment, or construction. In addition, submit evidence of the following:

1. TAB Field Supervisor: Full-time employee of the TAB specialist and certified by AABC.

a. TAB field supervisor shall have minimum 10 years supervisory experience in TAB work.

2. TAB Technician: Full-time employee of the TAB specialist and who is certified by AABC as a TAB technician.

a. TAB technician shall have minimum 4 years TAB field experience.

C. TAB Specialist engaged to perform TAB work in this Project shall be a business limited to and specializing in TAB work, or in TAB work and Commissioning.

D. TAB specialist engaged to perform TAB work shall not also perform commissioning activities on this Project.

E. Certified TAB field supervisor or certified TAB technician shall be present at the Project site at all times when TAB work is performed.

1. TAB specialist shall maintain at the Project site a minimum ratio of one certified field supervisor or technician for each non-certified employee at times when TAB work is being performed.

F. Contractor shall notify Architect in writing within three days of receiving direction resulting in reduction of test and balance scope or other deviations from Contract Documents. Deviations from the TAB plan shall be approved in writing by the mechanical engineer of record for the Project.

G. TAB Standard:

1. Perform TAB work in accordance with the requirements of the standard under which the TAB agencies' qualifications are approved unless Specifications contain different or more stringent requirements:

a. AABC National Standards for Total System Balance.

2. All recommendations and suggested practices contained in the TAB standard are mandatory. Use provisions of the TAB standard, including checklists and report forms, to the extent to which they are applicable to this Project.
3. Testing, adjusting, balancing procedures, and reporting required for this Project, and not covered by the TAB standard applicable to the TAB specialist engaged to perform the Work of this Contract, shall be submitted for approval by the design engineer.

H. TAB Conference: Meet with Architect and mechanical engineer on approval of the TAB strategies and procedures plan to develop a mutual understanding of the project requirements. Require the participation of the TAB field supervisor. Provide seven days' advance notice of scheduled meeting time and location. TAB conference shall take place at location selected by Architect offices of Capital.

1. Agenda Items:

a. The Contract Documents examination report.
b. The TAB plan.
c. Coordination and cooperation of trades and subcontractors.
d. Coordination of documentation and communication flow, including protocol for resolution tracking and documentation.

2. The requirement for TAB conference may be waived at the discretion of the mechanical engineer of record for the Project.

I. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

J. TAB Report Forms: Use standard TAB specialist's forms approved by Architect.

K. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

L. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

M. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.6 WARRANTY

A. Provide workmanship and performance warranty applicable to TAB specialist engaged to perform Work of this Contract:

1. AABC Performance Guarantee.

B. Refer to Division 01 Specifications for additional requirements.

1.1 COORDINATION

C. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

D. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

E. Coordinate TAB work with work of other trades.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contract Documents Examination Report:

1. TAB specialist shall review Contract Documents, including plans and specifications. Provide report listing conditions that would prevent the system(s) from operating in accordance with the sequence of operations specified, or would prevent accurate testing and balancing:

a. Identify each condition requiring correction using equipment designation shown on Drawings. Provide room number, nearest building grid line intersection, or other information necessary to identify location of condition requiring correction.
b. Proposed corrective action necessary for proper system operation.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan and pump curves.
1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

G. Examine test reports specified in individual system and equipment Sections.

H. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

I. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

J. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

K. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

L. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

M. Examine system pumps to ensure absence of entrained air in the suction piping.

N. Examine operating safety interlocks and controls on HVAC equipment.

O. Report conditions requiring correction discovered before and during performance of TAB procedures.

P. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures. TAB plan shall be specific to Project and include the following:

1. General description of each air system and sequence(s) of operation.
2. Complete list of measurements to be performed.
3. Complete list of measurement procedures. Specify types of instruments to be utilized and method of instrument application.
4. Qualifications of personnel assigned to Project.
5. Single-line CAD drawings reflecting all test locations (terminal units, grilles, diffusers, traverse locations, etc.
6. Table indicating pressure relationships (positive, negative, or neutral) between building spaces.
7. Air terminal correction factors for the following:

    a. Air terminal configuration.
    b. Flow direction (supply or return/exhaust).
    c. Effective area of each size and type of air terminal.
    d. Air density.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" and in this Section.

1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Test each system to verify building or space operating pressure, including all stages of economizer cycle. Maximum building pressure shall not exceed 0.03 inches of pressure.

C. Except as specifically indicated in this Specification, Pitot tube traverses shall be made of each duct to measure airflow. Pitot tubes, associated instruments, traverses, and techniques shall conform to ASHRAE Handbook, HVAC Applications, and ASHRAE Handbook, HVAC Systems and Equipment.

1. Use state-of-the-art instrumentation approved by TAB specialists governing agency.
2. Where ducts' design velocity and air quantity are both less than 1000 fpm/CFM, air quantity may be determined by measurements at terminals served.

D. Test holes shall be placed in straight duct, as far as possible downstream from elbow, bends, take-offs, and other turbulence-generating devices.

E. For variable-air-volume systems, develop a plan to simulate diversity.

F. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

G. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

H. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

I. Verify that motor starters are equipped with properly sized thermal protection.

J. Check dampers for proper position to achieve desired airflow path.

K. Check for airflow blockages.

L. Check condensate drains for proper connections and functioning.

M. Check for proper sealing of air-handling-unit components.

N. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

O. Provide for adjustments or modifications to fan and motor sheaves, belts, damper linkages, and other components as required to achieve specified air balance at no additional cost to Owner.

P. Automatically operated dampers shall be adjusted to operate as indicated in Contract Documents. Controls shall be checked for proper calibration.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

    a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow. Alternative methods shall be examined for determining total CFM, i.e., Pitot-tube traversing of branch ducts, coil or filter velocity profiles, prior to utilizing airflow values at terminal outlets and inlets.

2. Measure fan static pressures as follows to determine actual static pressure:

    a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
    b. Measure static pressure directly at the fan outlet.
    c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
    d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

    a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.

    a. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
    b. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Check operation of relief air dampers. Measure total relief air quantity at each stage of normal, economizer, power exhaust, or power exhaust economizer operation, as applicable to installed equipment. Adjust relief air dampers to provide 100 percent relief in economizer mode. Ensure that relief dampers close completely upon unit shutdown.

C. Check operation of outside air dampers. Measure total outside air quantity at each stage of normal, economizer, power exhaust, or power exhaust economizer operation, as applicable to installed equipment. Adjust outside air dampers to provide 100 percent outside air in economizer mode. Ensure that outside air dampers close completely upon unit shutdown.

D. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

E. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading digital backflow compensating hood. Use outlet manufacturer's written instructions and calculating factors only when direct-reading hood cannot be used due to physical obstruction or other limiting factors. Final report shall indicate where values listed have not been obtained by direct measurement.

F. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents, if included.
2. Adjust patterns of adjustable outlets for proper distribution without drafts. Terminal air velocity at five feet above finished floor shall not exceed 50 feet per minute in occupied air conditioned spaces.

G. Do not overpressurize ducts.

3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Comply with applicable requirements for constant-volume air systems in addition to those listed below.

B. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow with the remainder at maximum-airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.

C. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set outdoor-air dampers at minimum, and set return- and exhaust-air dampers at a position that simulates full-cooling load.

2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
3. Measure total system airflow. Adjust to within indicated airflow.
4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.

    a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.

6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.

    a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
8. Record final fan-performance data including optimum operating static control set point.

3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Complete air balance prior to hydronic systems balancing.

B. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed ranges given in article, Tolerances.

C. Prepare schematic diagrams of systems' "as-built" piping layouts.

D. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

1. Open all manual valves for maximum flow.
2. Check liquid level in expansion tank.
3. Check makeup water-station pressure gage for adequate pressure for highest vent.
4. Check flow-control valves for specified sequence of operation, and set at indicated flow.
5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
6. Set system controls so automatic valves are wide open to heat exchangers.
7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.8 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

A. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:

1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.

a. If impeller sizes must be adjusted to achieve pump performance, obtain approval from Architect and comply with requirements in Section 232123 "Hydronic Pumps."

2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.

a. Monitor motor performance during procedures and do not operate motors in overload conditions.

3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
4. Report flow rates that are not within ranges given in article, Tolerances.

B. Venturies and calibrated orifices with portable or permanent flow meters shall be used to balance the water flows. When such components have not been installed, measure temperature differential across coils or other elements and balance accordingly.

C. Measure flow at all automatic flow control valves to verify that valves are functioning as designed.

D. Measure flow at all pressure-independent characterized control valves, with valves in fully open position, to verify that valves are functioning as designed.

E. Set calibrated balancing valves, if installed, at calculated presettings.

F. Measure flow at all stations and adjust, where necessary, to obtain first balance.

1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

G. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.

H. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:

1. Determine the balancing station with the highest percentage over indicated flow.
2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
3. Record settings and mark balancing devices.

I. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.

J. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.

K. Check settings and operation of each safety valve. Record settings.

3.9 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

1.2 PROCEDURES FOR HEAT EXCHANGERS

A. Measure water flow through all circuits.

B. Adjust water flow to within specified tolerances.

C. Measure inlet and outlet water temperatures.

D. Measure inlet steam pressure.

E. Check settings and operation of safety and relief valves. Record settings.

1.3 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter manufacturer’s name, model number, size, type, and thermal-protection-element rating.

    a. Starter strip heater size, type, and rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

1.4 PROCEDURES FOR CHILLERS

A. Balance water flow through each evaporator to within specified tolerances of indicated flow with all pumps operating. With only one chiller operating in a multiple chiller installation, do not exceed the flow for the maximum tube velocity recommended by the chiller manufacturer. Measure and record the following data with each chiller operating at design conditions:

1. Evaporator-water entering and leaving temperatures, pressure drop, and water flow.
2. Evaporator and condenser refrigerant temperatures and pressures, using instruments furnished by chiller manufacturer.
3. Power factor if factory-installed instrumentation is furnished for measuring kilowatts.

4. Kilowatt input if factory-installed instrumentation is furnished for measuring kilowatts.
5. Capacity: Calculate in tons of cooling.
6. For air-cooled chillers, verify condenser-fan rotation and record fan and motor data including number of fans and entering- and leaving-air temperatures.

1.5 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

1.6 PROCEDURES FOR BOILERS

A. Hydronic Boilers: Measure and record entering- and leaving-water temperatures and water flow.

1.7 GENERAL PROCEDURES FOR PLUMBING SYSTEMS

A. Measure pressure drop across each backflow preventer assembly at design flows.

B. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:

1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.

    a. If impeller sizes must be adjusted to achieve pump performance, obtain approval from Architect Owner Construction Manager Commissioning Authority and comply with requirements in Section 225000 “Plumbing Equipment Section 221123 "Domestic Water Pumps."

2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.

    a. Monitor motor performance during procedures and do not operate motors in overload conditions.

3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
4. Report flow rates that are not within range given in article, Tolerances.

C. Set calibrated balancing valves, if installed, at calculated presettings.

D. Measure flow at all stations and adjust, where necessary, to obtain first balance.

1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

E. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.

F. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:

1. Determine the balancing station with the highest percentage over indicated flow.
2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
3. Record settings and mark balancing devices.

G. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.

H. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.

I. Check settings and operation of each safety valve. Record settings.

1.8 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 10 percent and minus 0 percent.
2. Air Outlets and Inlets: Plus 5 percent and minus 5 percent.
3. Multiple outlets within single room: Plus 5 percent and minus 0 percent for total airflow within room. Tolerance for individual outlets within a single room having multiple outlets shall be as for “Air Outlets and Inlets”.

a. Room shall be balanced to create pressure relationship (positive, negative, or neutral) with adjacent spaces as indicated on Drawings. Maintain airflow differentials between supply, return, and exhaust indicated on Drawings.

4. Heating-Water Flow Rate: Plus or minus 10 percent.
5. Cooling-Water Flow Rate: Plus or minus 10 percent.

B. Set plumbing systems water flow rates within plus or minus 10 percent.

1.9 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Interim Reports: Prepare periodic lists of conditions requiring correction and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

1.10 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing field supervisor. Report shall be co-signed by the Contractor, attesting that he has reviewed the report, and the report has been found to be complete and accurate.
2. The certification sheet shall be followed by sheet(s) listing items for which balancing objectives could not be achieved. Provide explanation for failure to achieve balancing objectives for each item listed.
3. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Project Performance Guaranty
6. Architect's name and address.
7. Engineer's name and address.
8. Contractor's name and address.
9. Report date.
10. Signature of TAB supervisor who certifies the report.
11. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
12. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

13. Nomenclature sheets for each item of equipment.
14. Data for terminal units, including manufacturer's name, type, size, and fittings.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.

h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Air distribution outlets and inlets shall be shown on keyed plans with designation for each outlet and inlet matching designation used in Contract Documents and TAB test reports. Room numbers shall be included in keyed plans and test reports. Where multiple outlets and inlets are installed within a single room, a designation shall be assigned and listed for each outlet and inlet in addition to room number.

F. Test Reports – General:

1. All test reports containing air or liquid flow data shall record flow values prior to system adjustment in addition to required data listed for each test report.

G. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Unit arrangement and class.
g. Discharge arrangement.
h. Sheave make, size in inches, and bore.
i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
j. Number, make, and size of belts.
k. Number, type, and size of filters.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. VFD model and number.

3. Test Data (Indicated and Actual Values):

    a. Total air flow rate in cfm.
    b. Total system static pressure in inches wg.
    c. Fan rpm.
    d. Discharge static pressure in inches wg.
    e. Filter static-pressure differential in inches wg.
    f. Preheat-coil static-pressure differential in inches wg.
    g. Cooling-coil static-pressure differential in inches wg.
    h. Heating-coil static-pressure differential in inches wg.
    i. Outdoor airflow in cfm.
    j. Return airflow in cfm.
    k. Relief airflow in cfm.
    l. Outdoor-air damper position, normal and economizer, power exhaust, or power exhaust economizer modes, as applicable to installed equipment.
    m. Return-air damper position.
    n. Relief-air damper position, normal and economizer, power exhaust, or power exhaust economizer modes, as applicable to installed equipment.
    o. Vortex damper position.

H. Apparatus-Coil Test Reports:

1. Coil Data:

    a. System identification.
    b. Location.
    c. Coil type.
    d. Number of rows.
    e. Fin spacing in fins per inch o.c.
    f. Make and model number.
    g. Face area in sq. ft.
    h. Tube size in NPS.
    i. Tube and fin materials.
    j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

    a. Air flow rate in cfm.
    b. Average face velocity in fpm.
    c. Air pressure drop in inches wg.
    d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
    e. Return-air, wet- and dry-bulb temperatures in deg F.
    f. Entering-air, wet- and dry-bulb temperatures in deg F.
    g. Leaving-air, wet- and dry-bulb temperatures in deg F.
    h. Water flow rate in gpm.
    i. Water pressure differential in feet of head or psig.

j. Entering-water temperature in deg F.
k. Leaving-water temperature in deg F.
l. Refrigerant expansion valve and refrigerant types.
m. Inlet steam pressure in psig.

I. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

J. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft..

g. Indicated air flow rate in cfm.
h. Indicated velocity in fpm.
i. Actual air flow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

K. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Apparatus used for test.
d. Area served.
e. Make.
f. Number from system diagram.
g. Type and model number.
h. Size.
i. Effective area in sq. ft.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Air velocity in fpm.
c. Preliminary air flow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final air flow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

L. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:

a. System and air-handling-unit identification.
b. Location and zone.
c. Room or riser served.
d. Coil make and size.
e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Entering-water temperature in deg F.
c. Leaving-water temperature in deg F.
d. Water pressure drop in feet of head or psig.
e. Entering-air temperature in deg F.

f. Leaving-air temperature in deg F.

M. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Service.
d. Make and size.
e. Model number and serial number.
f. Water flow rate in gpm.
g. Water pressure differential in feet of head or psig.
h. Required net positive suction head in feet of head or psig.
i. Pump rpm.
j. Impeller diameter in inches.
k. Motor make and frame size.
l. Motor horsepower and rpm.
m. Voltage at each connection.
n. Amperage for each phase.
o. Full-load amperage and service factor.
p. Seal type.

2. Test Data (Indicated and Actual Values):

a. Static head in feet of head or psig.
b. Pump shutoff pressure in feet of head or psig.
c. Actual impeller size in inches.
d. Full-open flow rate in gpm.
e. Full-open pressure in feet of head or psig.
f. Final discharge pressure in feet of head or psig.
g. Final suction pressure in feet of head or psig.
h. Final total pressure in feet of head or psig.
i. Final water flow rate in gpm.
j. Voltage at each connection.
k. Amperage for each phase.

N. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

1.11 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:

a. Measure airflow of at least 10 percent of air outlets.
b. Measure water flow of at least 5 percent of terminals.
c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
d. Verify that balancing devices are marked with final balance position.
e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
2. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Architect.
3. Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than 10 percent, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contact the TAB specialists' governing organization for remedial action by the governing organization under the workmanship and performance warranty. See article, Warranty.
3. If remedial action is not provided by the TAB specialists' governing organization in a timely manner, Owner may contract the services of another TAB specialist to complete the TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB specialists' final payment.

D. Prepare test and inspection reports.

1.12 ADDITIONAL TESTS

A. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 23 07 13 - DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply.

B. Related Sections:

1. Section 23 07 16 "HVAC Equipment Insulation."
2. Section 23 07 19 "HVAC Piping Insulation."
3. Section 233113 "Metal Ducts" for duct liners.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

B. Product Data for California Green Building Standards Code Compliance: For adhesives and sealants, including primers, documentation of compliance including printed statement of VOC content and chemical components.

C. Product data for insulation products, including insulation, insulation facings, jackets, adhesives, sealants, and coatings, indicating compliance with requirement that these products contain less than 0.1 percent (by mass) polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations.

D. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

B. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).

C. Products shall not contain asbestos, lead, mercury, or mercury compounds.

D. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

E. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. CertainTeed Corporation.
b. Johns Manville; a Berkshire Hathaway company.
c. Knauf Insulation.
d. Manson Insulation Inc.
e. Owens Corning.

G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. CertainTeed Corporation.
b. Johns Manville; a Berkshire Hathaway company.
c. Knauf Insulation.
d. Manson Insulation Inc.
e. Owens Corning.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Childers Brand; H. B. Fuller Construction Products.
b. Eagle Bridges - Marathon Industries.
c. Foster Brand; H. B. Fuller Construction Products.
d. Mon-Eco Industries, Inc.

2. Fiberglass adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

C. FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Childers Brand; H. B. Fuller Construction Products.
b. Eagle Bridges - Marathon Industries.
c. Foster Brand; H. B. Fuller Construction Products.
d. Mon-Eco Industries, Inc.

2. Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. VOC Content: 300 g/L or less.

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.
c. Knauf Insulation.
d. Vimasco Corporation.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.

5. Color: White.

2.4 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Adhesives shall have a VOC content of 50 g/L or less.
2. Adhesive shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.
3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
   a. Childers Brand; H. B. Fuller Construction Products.
   b. Foster Brand; H. B. Fuller Construction Products.
   c. Vimasco Corporation.
4. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
5. Service Temperature Range: 0 to plus 180 deg F.
6. Color: White.

2.5 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
   a. Childers Brand; H. B. Fuller Construction Products.
   b. Eagle Bridges - Marathon Industries.
   c. Foster Brand; H. B. Fuller Construction Products.
   d. Mon-Eco Industries, Inc.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. Sealant shall have a VOC content of 420 g/L or less.
7. Sealant shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.
8. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. in. for covering ducts.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Childers Brand; H. B. Fuller Construction Products.

B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for ducts.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Foster Brand; H. B. Fuller Construction Products.
b. Vimasco Corporation.

2.8 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Alpha Associates, Inc.

2.9 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Avery Dennison Corporation, Specialty Tapes Division.
b. Compac Corporation.
c. Ideal Tape Co., Inc.; an American Biltrite company.
d. Knauf Insulation.
e. Venture Tape.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.

5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Avery Dennison Corporation, Specialty Tapes Division.
b. Compac Corporation.
c. Ideal Tape Co., Inc.; an American Biltrite company.
d. Knauf Insulation.
e. Venture Tape.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.10 SECUREMENTS

A. Bands:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. ITW Insulation Systems; Illinois Tool Works, Inc.
b. RPR Products, Inc.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 316; 0.015 inch thick, 3/4 inch wide with wing seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, [1/2 inch] [3/4 inch] wide with [wing seal] [or] [closed seal].
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch-diameter shank, length to suit depth of insulation indicated.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1) AGM Industries, Inc.
2) Gemco.
3) Hardcast, Inc.
4) Midwest Fasteners, Inc.
5) Nelson Stud Welding.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

        1) AGM Industries, Inc.
        2) CL WARD & Family Inc.
        3) Gemco.
        4) Hardcast, Inc.
        5) Midwest Fasteners, Inc.
        6) Nelson Stud Welding.

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

        1) AGM Industries, Inc.
        2) Gemco.
        3) Midwest Fasteners, Inc.

    b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
    c. Spindle: Stainless steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
    d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

        1) AGM Industries, Inc.
        2) Gemco.
        3) Hardcast, Inc.
        4) Midwest Fasteners, Inc.
        5) Nelson Stud Welding.

    b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire: 0.062-inch soft-annealed, stainless steel.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. C & F Wire.

2.11 CORNER ANGLES

A. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.03 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.04 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Section 078413 "Penetration Firestopping" and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.05 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
d. Do not overcompress insulation during installation.
e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.7 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply air.

B. Items Not Insulated:

1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
2. Factory-insulated flexible ducts.
3. Factory-insulated plenums and casings.
4. Flexible connectors.
5. Vibration-control devices.
6. Factory-insulated access panels and doors.

3.8 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, round and flat-oval, supply-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 1-1/2 inches thick, R-4.2.

B. Concealed, rectangular, supply-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 1-1/2 inches thick, R-4.2.
2. Mineral-Fiber Board: 1-1/2 inches thick, R-4.2

C. Concealed, supply-air and return-air plenum insulation shall be one of the following:

1. Mineral-Fiber Blanket: 1-1/2 inches thick, R-4.2.
2. Mineral-Fiber Board: 1-1/2 inches thick, R-4.2.

END OF SECTION 230713

This page intentionally left blank.

SECTION 23 07 16 - HVAC EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes insulating the following HVAC equipment that is not factory insulated:

1. Chilled-water pumps.
2. Heating, hot-water pumps.
3. Expansion tanks.
4. Air separators.

B. Related Sections:

1. Section 23 07 13 "Duct Insulation."
2. Section 23 07 19 "HVAC Piping Insulation."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

B. Product Data for California Green Building Standards Code Compliance: For adhesives and sealants, including primers, documentation of compliance including printed statement of VOC content and chemical components.

C. Product data for insulation products, including insulation, insulation facings, jackets, adhesives, sealants, and coatings, indicating compliance with requirement that these products contain less than 0.1 percent (by mass) polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations.

D. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Product Data: For coatings, indicating VOC content.
3. Product Data: For sealants, indicating VOC content.

E. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail removable insulation at equipment connections.
3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.

5. Detail field application for each equipment type.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with equipment Installer for equipment insulation application.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Equipment Insulation Schedule" articles for where insulating materials shall be applied.

B. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).

C. Products shall not contain asbestos, lead, mercury, or mercury compounds.

D. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

E. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

F. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. Provide insulation with factory-applied FSK. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. CertainTeed Corporation.
b. Johns Manville; a Berkshire Hathaway company.
c. Knauf Insulation.
d. Manson Insulation Inc.
e. Owens Corning.

G. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. CertainTeed Corporation.
b. Johns Manville; a Berkshire Hathaway company.
c. Knauf Insulation.
d. Manson Insulation Inc.
e. Owens Corning.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Ramco Insulation, Inc.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Ramco Insulation, Inc.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Ramco Insulation, Inc.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Eagle Bridges - Marathon Industries.
    c. Foster Brand; H. B. Fuller Construction Products.
    d. Mon-Eco Industries, Inc.

2. Fiberglass adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

C. FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Eagle Bridges - Marathon Industries.
    c. Foster Brand; H. B. Fuller Construction Products.
    d. Mon-Eco Industries, Inc.

2. Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. VOC Content: 300 g/L or less.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Foster Brand; H. B. Fuller Construction Products.
   b. Knauf Insulation.
   c. Vimasco Corporation.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.
6. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Childers Brand; H. B. Fuller Construction Products.
   b. Eagle Bridges - Marathon Industries.
   c. Foster Brand; H. B. Fuller Construction Products.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

D. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Childers Brand; H. B. Fuller Construction Products.
   b. Eagle Bridges - Marathon Industries.
   c. Foster Brand; H. B. Fuller Construction Products.
   d. Knauf Insulation.
   e. Mon-Eco Industries, Inc.

f. Vimasco Corporation.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Adhesives shall have a VOC content of 50 g/L or less.
2. Adhesive shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.
3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Childers Brand; H. B. Fuller Construction Products.
   b. Foster Brand; H. B. Fuller Construction Products.
   c. Vimasco Corporation.

4. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over equipment insulation.
5. Service Temperature Range: 0 to plus 180 deg F.
6. Color: White.

2.6 SEALANTS

A. Joint Sealants:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Childers Brand; H. B. Fuller Construction Products.
   b. Eagle Bridges - Marathon Industries.
   c. Foster Brand; H. B. Fuller Construction Products.
   d. Mon-Eco Industries, Inc.
   e. Pittsburgh Corning Corporation.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F.
5. Color: White or gray.
6. Sealant shall have a VOC content of 420 g/L or less.
7. Sealant shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

B. FSK and Metal Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Eagle Bridges - Marathon Industries.
    c. Foster Brand; H. B. Fuller Construction Products.
    d. Mon-Eco Industries, Inc.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. Sealant shall have a VOC content of 420 g/L or less.
7. Sealant shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. in. for covering equipment.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Childers Brand; H. B. Fuller Construction Products.

B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for equipment.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Foster Brand; H. B. Fuller Construction Products.
    b. Vimasco Corporation.

2.9 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Alpha Associates, Inc.

2.10 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. Metal Jacket:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Childers Brand; H. B. Fuller Construction Products.
    b. ITW Insulation Systems; Illinois Tool Works, Inc.
    c. RPR Products, Inc.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

    a. Factory cut and rolled to size.
    b. Finish and thickness are indicated in field-applied jacket schedules.
    c. Moisture Barrier for Indoor Applications: 2.5-mil- thick polysurlyn.
    d. Moisture Barrier for Outdoor Applications: 2.5-mil- thick polysurlyn.
    e. Factory-Fabricated Fitting Covers:

        1) Same material, finish, and thickness as jacket.
        2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
        3) Tee covers.
        4) Flange and union covers.
        5) End caps.
        6) Beveled collars.
        7) Valve covers.
        8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.11 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Avery Dennison Corporation, Specialty Tapes Division.
    b. Compac Corporation.
    c. Ideal Tape Co., Inc.; an American Biltrite company.
    d. Knauf Insulation.
    e. Venture Tape.

2. Width: 3 inches.

3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Avery Dennison Corporation, Specialty Tapes Division.
    b. Compac Corporation.
    c. Ideal Tape Co., Inc.; an American Biltrite company.
    d. Knauf Insulation.
    e. Venture Tape.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.12 SECUREMENTS

A. Bands:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. ITW Insulation Systems; Illinois Tool Works, Inc.
    b. RPR Products, Inc.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 316; 0.015 inch thick, 3/4 inch wide with wing seal or closed seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch-diameter shank, length to suit depth of insulation indicated.

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

        1) AGM Industries, Inc.
        2) Gemco.
        3) Midwest Fasteners, Inc.

4) Nelson Stud Welding.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1) AGM Industries, Inc.
2) Gemco.
3) Midwest Fasteners, Inc.
4) Nelson Stud Welding.

3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1) AGM Industries, Inc.
2) Gemco.
3) Midwest Fasteners, Inc.
4) Nelson Stud Welding.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire: 0.062-inch soft-annealed, stainless steel.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. C & F Wire.

2.13 CORNER ANGLES

A. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

O. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 INSTALLATION OF EQUIPMENT, TANK, AND VESSEL INSULATION

A. Mineral-Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
3. Protect exposed corners with secured corner angles.
4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:

    a. Do not weld anchor pins to ASME-labeled pressure vessels.
    b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
    c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
    d. Do not overcompress insulation during installation.
    e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.

f. Impale insulation over anchor pins and attach speed washers.
g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
7. Stagger joints between insulation layers at least 3 inches.
8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

B. Insulation Installation on Pumps:

1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch centers, starting at corners. Install 3/8-inch- diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
2. Fabricate boxes from stainless steel, at least 0.060 inch thick.
3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.5 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.6 FINISHES

A. Do not field paint aluminum or stainless-steel jackets.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections: Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

1.1 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Insulate indoor and outdoor equipment that is not factory insulated.

C. Chilled-water pump insulation shall be one of the following:

1. Mineral-Fiber Board: 2 inches thick and 6-lb/cu. ft. nominal density.

D. Heating-hot-water pump insulation shall be one of the following:

1. Mineral-Fiber Board: 2 inches thick and 6-lb/cu. ft. nominal density.

E. Heating-hot-water expansion/compression tank insulation shall be one of the following:

1. Mineral-Fiber Board: 1 inch thick and 3-lb/cu. ft. nominal density.
2. Mineral-Fiber Pipe and Tank: 1-1/2 inch thick.

F. Chilled-water air-separator insulation shall be one of the following:

1. Mineral-Fiber Board: 1 inch thick and 3-lb/cu. ft. nominal density.
2. Mineral-Fiber Pipe and Tank: 1-1/2 inch thick.

1.2 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:

1. Painted Aluminum, Smooth with Z-Shaped Locking Seam: 0.040 inch thick.

END OF SECTION 230716

SECTION 230719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes insulating the following HVAC piping systems:

1. Condensate drain piping, indoors and outdoors.
2. Chilled-water and brine piping, outdoors.
3. Heating hot-water piping, indoors and outdoors.
4. Refrigerant suction, liquid and hot-gas piping, indoors and outdoors.

B. Related Sections:

1. Section 230713 "Duct Insulation."
2. Section 230716 "HVAC Equipment Insulation."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

B. Product Data for California Green Building Standards Code Compliance: For adhesives and sealants, including primers, documentation of compliance including printed statement of VOC content and chemical components.

C. Product data for insulation products, including insulation, insulation facings, jackets, adhesives, sealants, and coatings, indicating compliance with requirement that these products contain less than 0.1 percent (by mass) polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations.

D. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at pipe expansion joints for each type of insulation.
3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
4. Detail removable insulation at piping specialties.
5. Detail application of field-applied jackets.
6. Detail application at linkages of control devices.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).

C. Products shall not contain asbestos, lead, mercury, or mercury compounds.

D. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

E. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

F. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Aeroflex USA, Inc.
b. Armacell LLC.
c. K-Flex USA.

H. Mineral-Fiber, Preformed Pipe Insulation:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Johns Manville; a Berkshire Hathaway company.
b. Knauf Insulation.
c. Manson Insulation Inc.
d. Owens Corning.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Ramco Insulation, Inc.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Ramco Insulation, Inc.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Ramco Insulation, Inc.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Aeroflex USA, Inc.
    b. Armacell LLC.
    c. Foster Brand; H. B. Fuller Construction Products.
    d. K-Flex USA.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Eagle Bridges - Marathon Industries.
    c. Foster Brand; H. B. Fuller Construction Products.
    d. Mon-Eco Industries, Inc.

2. Fiberglass adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

D. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Childers Brand; H. B. Fuller Construction Products.
b. Eagle Bridges - Marathon Industries.
c. Foster Brand; H. B. Fuller Construction Products.
d. Mon-Eco Industries, Inc.

2. Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. VOC Content: 300 g/L or less.

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Foster Brand; H. B. Fuller Construction Products.
b. Vimasco Corporation.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Childers Brand; H. B. Fuller Construction Products.
b. Eagle Bridges - Marathon Industries.
c. Foster Brand; H. B. Fuller Construction Products.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.

5. Color: White.

D. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Childers Brand; H. B. Fuller Construction Products.
b. Eagle Bridges - Marathon Industries.
c. Foster Brand; H. B. Fuller Construction Products.
d. Mon-Eco Industries, Inc.
e. Vimasco Corporation.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Adhesives shall have a VOC content of 50 g/L or less.
2. Adhesive shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.
c. Vimasco Corporation.

4. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
5. Service Temperature Range: 0 to plus 180 deg F.
6. Color: White.

2.6 SEALANTS

A. Metal Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Childers Brand; H. B. Fuller Construction Products.
b. Eagle Bridges - Marathon Industries.
c. Foster Brand; H. B. Fuller Construction Products.
d. Mon-Eco Industries, Inc.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. Sealant shall have a VOC content of 420 g/L or less.
7. Sealant shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

B. ASJ Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Childers Brand; H. B. Fuller Construction Products.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. Sealant shall have a VOC content of 420 g/L or less.
7. Sealant shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Childers Brand; H. B. Fuller Construction Products.

B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Foster Brand; H. B. Fuller Construction Products.
   b. Vimasco Corporation.

2.9 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Alpha Associates, Inc.

2.10 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Johns Manville; a Berkshire Hathaway company.
b. P.I.C. Plastics, Inc.
c. Proto Corporation.
d. Speedline Corporation.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

C. Metal Jacket:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Childers Brand; H. B. Fuller Construction Products.
b. ITW Insulation Systems; Illinois Tool Works, Inc.
c. RPR Products, Inc.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. Sheet and roll stock ready for shop or field sizing or Factory cut and rolled to size.
b. Finish and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Indoor Applications: 2.5-mil- thick polysurlyn.
d. Moisture Barrier for Outdoor Applications: 2.5-mil- thick polysurlyn.
e. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.11 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Avery Dennison Corporation, Specialty Tapes Division.
b. Compac Corporation.
c. Ideal Tape Co., Inc,; an American Biltrite company.
d. Knauf Insulation.
e. Venture Tape.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Avery Dennison Corporation, Specialty Tapes Division.
b. Compac Corporation.
c. Ideal Tape Co., Inc,; an American Biltrite company.
d. Knauf Insulation.
e. Venture Tape.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.12 SECUREMENTS

A. Bands:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. ITW Insulation Systems; Illinois Tool Works, Inc.
    b. RPR Products, Inc.
2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.
3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless steel.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. C & F Wire.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space

between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.9 FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

B. Do not field paint aluminum jackets.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings,

two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

3.12 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Chilled Water and Brine, above 40 Deg F:

1. All Sizes: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe, Type I: 1inch thick.

C. Heating-Hot-Water Supply and Return, 200 Deg F and Below:

1. NPS 1-1/4 and Smaller: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe, Type I: 1-1/2 inches thick.

2. NPS 1-1/2 and Larger: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe, Type I: 2 inches thick.

D. Refrigerant Suction, Liquid, and Hot-Gas Piping:

1. NPS 3/4 and Smaller: Insulation shall be the following:
   a. Flexible Elastomeric: 1 inch thick.

2. NPS 1 and Larger: Insulation shall be the following:
   a. Flexible Elastomeric: 1-1/2 inches thick.

E. Refrigerant Suction, Liquid, and Hot-Gas Flexible Tubing:

1. NPS 3/4 and Smaller: Insulation shall be the following:

   a. Flexible Elastomeric: 1 inch thick.

2. NPS 1 and Larger: Insulation shall be the following:

   a. Flexible Elastomeric: 1-1/2 inches thick.

3.13 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Chilled Water and Brine:

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

B. Heating-Hot-Water Supply and Return, 200 Deg F and Below:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

C. Refrigerant Suction, Liquid, and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be the following:
   a. Flexible Elastomeric: 2 inches thick.

D. Refrigerant Suction, Liquid, and Hot-Gas Flexible Tubing:

1. All Pipe Sizes: Insulation shall be the following:

   a. Flexible Elastomeric: 2 inches thick.

E. Insulation for cased underground piping systems is specified in Section 232113.13 "Underground Hydronic Piping."

3.14 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.

D. Piping, Exposed:

1. PVC: 30 mils thick.

3.15 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Exposed:

1. Aluminum, Smooth with Z-Shaped Locking Seam: 0.040 inch thick.

3.16 PIPE PROTECTION

A. Field-installed insulation jacket may be omitted for manufactured, pre-charged and pre-insulated refrigerant line-set piping run in rigid or flexible conduit.

B. Field-installed insulation jacket may be omitted for field-assembled refrigerant piping run in rigid or flexible conduit.

C. Refer to Article, Piping Installation, in Section 232300 “Refrigerant Piping,” for refrigerant pipe protection requirements.

END OF SECTION 230719

SECTION 230923 - DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish a campus standard Alerton Compass System. The operator's workstation, all building controllers, application controllers, and all input/output devices shall communicate using the protocols and network standards as defined by ANSI/ ASHRAE Standard 135-2008, BACnet. All workstations and controllers, including unitary controllers, shall be native BACnet MSTP or BACnet IP devices. No gateways shall be used for communication to controllers installed under this section. Gateways may be used for communication to existing systems or to systems installed under other sections.

B. Provide all necessary BACnet-compliant hardware and software to meet the system's functional specifications. Provide Protocol Implementation Conformance Statement (PICS) for Windows-based control software and every controller in system, including unitary controllers.

C. Prepare individual hardware layouts, interconnection drawings, and software configuration from project design data.

D. Implement the detailed design for all analog and binary objects, system databases, graphic displays, logs, and management reports based on control descriptions, logic drawings, configuration data, and bid documents.

E. Design, provide, and install all equipment cabinets, panels, data communication network cables needed, and all associated hardware.

F. Provide and install all interconnecting cables between supplied cabinets, application controllers, and input/output devices.

G. Provide and install all interconnecting cables between all operator's terminals and peripheral devices (such as printers, etc.) supplied under this section.

H. Provide complete manufacturer's specifications for all items that are supplied. Include vendor name of every item supplied.

I. Provide supervisory specialists and technicians at the job site to assist in all phases of system installation, startup, and commissioning.

J. Provide a comprehensive operator and technician training program as described herein.

K. Provide as-built documentation, operator's terminal software, diagrams, and all other associated project operational documentation (such as technical manuals) on approved media, the sum total of which accurately represents the final system.

L. Provide new sensors, dampers, valves, and install only new electronic actuators. No used components shall be used as any part or piece of installed system.

M. Include as an added bid item the cost of the service contract for the remote monitoring of all BMS controlled systems in the building.

N. Include as an added bid item the cost of the scheduling modifications and refinement with the tenant.

1.2 SYSTEM DESCRIPTION

A. A distributed logic control system complete with all software and hardware functions shall be provided and installed. System shall be completely based on ANSI/ASH RAE Standard 135-2008, BACnet and achieved listing under the BACnet Testing Laboratories BACnet - Advanced Workstation Software (B-AWS). This system is to control all mechanical equipment, including all unitary equipment such as VAV boxes, AC units, etc., and all air handlers, boilers, lighting control panels, UPS, generators, building elevators, and any other listed equipment using native BACnet-compliant components. Non-BACnet-compliant or proprietary equipment or systems (including gateways) shall not be acceptable and are specifically prohibited.

B. Provide integration to the lighting system through BACnet IP protocol so the lighting can be scheduled through the DOC system and include graphics that show whether lights are on or off on the floor plans. The DOC system shall be able to interface with the lighting control panel to facilitate scheduling, automatic daylight saving time adjustments, etc.

C. Operator's workstation software shall use Microsoft Windows 8 or Windows 10 as the computer operating system. The Direct Digital Control system (DOC) application program shall be written to communicate specifically utilizing BACnet protocols. Software functions delivered on this project shall include password protection, scheduling (including optimum start), alarming, logging of historical data, full graphics including animation, after-hours billing program, demand limiting, and a full suite of field engineering tools including graphical programming and applications. Systems using operating systems other than that described above are strictly prohibited. All software required to program application specific controllers and all field level devices and controllers will be left with the owner. All software passwords required to program and make future changes to the system will also become the property of the owner. All software required to make any program changes anywhere in the system, along with scheduling and trending applications, will be left with the owner. All software passwords required to program and make future changes to schedules, trends and related program changes will also become the property of the owner. All software required for all field engineering tools including graphical programming and applications will be left with the owner. All software passwords required to program and make future changes to field engineering tools, including graphical programming and applications will be left with the owner.

D. Building controllers shall include complete energy management software, including scheduling building control strategies with optimum start and logging routines. All energy management software and firmware shall be resident in field hardware and shall not be dependent on the operator's terminal. Operator's terminal software is to be used for access to field-based energy management functions only. Provide zone-by-zone direct digital logic control of space temperature, scheduling, runtime accumulation, equipment alarm reporting, and override timers for after-hours usage.

E. Room sensors shall be provided with digital readout that allows the user to view room temperature and humidity, adjust the room setpoint within preset limits and set desired override time. User shall also be able to start and stop unit from the digital sensor. Include all necessary wiring and firmware such that room sensor includes field service mode. Field service mode shall allow a technician to balance VAV zones and access any parameter in zone controller directly from the room sensor. Field service mode shall have the ability to be locked out.

F. All application controllers for every terminal unit (VAV, FCU, etc.) air handler, all central plant equipment, and any other piece of controlled equipment shall be fully programmable. Application controllers shall be mounted next to controlled equipment and communicate with building controller through BACnet MSTP.

1.3 APPROVED MANUFACTURERS

A. Approved Control Manufacturers

1. Alerton Compass (integrated into existing Alerton Compass network)
2. Other systems will not be accepted.

1.4 QUALITY ASSURANCE

A. The Building Automation System (BAS) system shall be designed, installed, commissioned, and serviced by manufacturer authorized and trained personnel. System provider shall have an in-place support facility within 2 hours' response time of the site with technical staff, spare parts inventory, and necessary test and diagnostic equipment.

B. The contractor shall provide full-time, on-site, experienced project manager for this work, responsible for direct supervision of the design, installation, start-up and commissioning of the BAS system.

C. The Bidder shall be regularly engaged in the design, installation and maintenance of BAS systems and shall have demonstrated technical expertise and experience in the design, installation and maintenance of BAS systems similar in size and complexity to this project.

D. Materials and equipment shall be manufacturer's latest standard design that complies with the specification requirements.

E. All BAS peer-to-peer network controllers, central system controllers and local user displays shall be UL Listed under Standard UL 916, category PAZX.

F. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.

G. Control system shall be engineered, programmed and supported completely by representative's local office

1.5 REFERENCE STANDARDS

A. The latest edition of the following standards and codes in effect and amended as of supplier's proposal date, and any applicable subsections thereof, shall govern design and selection of equipment and material supplied:

1. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
2. ANSI/ASHRAE Standard 135-2008, BACnet.
3. Uniform Building Code (UBC), including local amendments.
4. UL 916 Underwriters Laboratories Standard for Energy Management Equipment. Canada and the US.
5. National Electrical Code (NEC).
6. FCC Part 15, Subpart J, Class A
7. EMC Directive 89/336/EEC (European CE Mark).
8. UL-864 UUKL listing for Smoke Controls for any equipment used in smoke control sequences.

B. City, county, state, and federal regulations and codes in effect as of contract date.

C. Except as otherwise indicated, the system supplier shall secure and pay for all permits, inspections, and certifications required for his work, and arrange for necessary approvals by the governing authorities.

1.6 SUBMITTALS

A. Drawings

1. The system supplier shall submit engineered drawings, control sequence, and bill of materials for approval.
2. Drawings shall be submitted in the following standard sizes: 11" x 17" (ANSI B).
3. Eight complete sets (copies) of submittal drawings shall be provided.
4. Drawings shall be available on CD-ROM.

B. System Documentation: Include the following in submittal package:

1. System configuration diagrams in simplified block format.
2. All input/output object listings and an alarm point summary listing.
3. Electrical drawings that show all system internal and external connection points, terminal block layouts, and terminal identification.
4. Complete bill of materials, valve schedule and damper schedule.
5. Manufacturer's instructions and drawings for installation, maintenance, and operation of all purchased items.
6. Overall system operation and maintenance instructions- including preventive maintenance and troubleshooting instructions.
7. For all system elements-operator's workstation(s), building controller(s), application controllers, routers, and repeaters- provide BACnet Protocol Implementation Conformance Statements (PICS) as per ANSI/ ASHRAE Standard 135-2001.
8. Provide complete description and documentation of any proprietary (non-BACnet) services and/or objects used in the system.
9. A list of all functions available and a sample of function block programming that shall be part of delivered system.

C. Project Management

1. The vendor shall provide a detailed project design and installation schedule with time markings and details for hardware items and software development phases. Schedule shall show all the target dates for transmission of project information and documents, and shall indicate timing and dates for system installation, debugging, and commissioning.

1.7 WARRANTY

A. Warranty shall cover all costs for parts, labor, associated travel, and expenses for a period of one year from completion of system acceptance.

B. Hardware and software personnel supporting this warranty agreement shall provide on-site or off-site service in a timely manner after failure notification to the vendor. The maximum acceptable response time to provide this service at the site shall be 24 hours, Monday through Friday and 48 hours on Saturday and Sunday.

C. This warranty shall apply equally to both hardware and software.

PART 2 - PRODUCTS

2.1 OPERATOR'S WORKSTATION

A. General structure of workstation interaction shall be a standard client/server relationship. Server shall be used to archive data and store system database. Clients shall access server for all archived data. Each client shall include flexibility to access graphics from server or local drive. Server shall support a minimum of 50 simultaneous clients.

B. BACnet Conformance

1. Operator Work Station shall be approved by the BTL as meeting the BACnet Advanced Work Station requirements.
2. Refer to Section 22.2, BACnet Functional Groups, in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
3. Standard BACnet object types accessed by the workstation shall include as a minimum: Analog *Value,* Analog Input, Analog Output, Binary Value, Binary Input, Binary Output, Calendar, Device, Event Enrollment, File, Notification Class, Program, and Schedule object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
4. The operator's workstation shall comply with Annex J of the BACnet specification for IP connections. Must support remote connection to server using a thick client application. This device shall use Ethernet to connect to the IP internetwork, while using the same Ethernet LAN for non-IP communications to other BACnet devices on the LAN. Must support interoperability on wide area networks (WANs) and campus area networks (CANs). Workstation shall support Foreign Device Registration to allow temporary workstation connection to IP network.

C. Displays

1. Operator's workstation shall display all data associated with project as called out on drawings and/or object type list supplied. Graphic files shall be created using digital, full color photographs of system installation, AutoCAD or Visio drawing files of field installation drawings and wiring diagrams from as-built drawings. Operator's workstation shall display all data using three-dimensional graphic representations of all mechanical equipment. System shall be capable of displaying graphic file, text, and dynamic object data together on each display and shall include animation. Information shall be labeled with descriptors and shall be shown with the appropriate engineering units. All information on any display shall be dynamically updated without any action by the user. Workstation shall allow user to change all field-resident EMCS functions associated with the project, such as setpoints, weekly schedules, exception schedules, etc., from any screen, no matter if that screen shows all text or a complete graphic display. This shall be done without any reference to object addresses or other numeric/mnemonic indications.
2. All displays and programming shall be generated and customized by the local EMCS supplier and installer. Systems requiring factory development of graphics or programming of DOC logic are specifically prohibited.
3. Binary objects shall be displayed as ACTIVE/INACTIVE/NULL or with customized text such as Hand-Off-Auto. Text shall be justified left, right or center as selected by the user. Also, allow binary objects to be displayed as individual change-of-state graphic objects on the display screen such that they overlay the system graphic. Each binary object displayed in this manner shall be assigned up to three graphic files for display when the point is ON, OFF or in alarm. For binary outputs, toggle the object's commanded status when the graphic item is selected with the system mouse. Similarly, allow the workstation operator to toggle the binary object's status by selecting with the mouse, for example, a graphic of a switch or light, which then displays a different graphic (such as an "ON" switch or lighted lamp. Additionally, allow binary objects to be displayed as an animated graphic. Animated graphic objects shall be displayed as a sequence of multiple graphics to simulate motion. For example, when a pump is in the OFF condition, display a

stationary graphic of the pump. When the operator selects the pump graphic with the mouse, the represented object's status is toggled and the graphic of the pump's impeller rotates in a time- based animation. The operator shall be able to click an animated graphical object or switch it from the OFF position to ON, or ON to OFF. Allow operator to change graphic file assignment and also create new and original graphics online. System shall be supplied with a library of standard graphics, which may be used unaltered or modified by the operator. Systems that do not allow customization or creation of new graphic objects by the operator (or with third-party software) shall not be allowed.

4. Analog objects shall be displayed with operator modifiable units. Analog input objects may also be displayed as individual graphic items on the display screen as an overlay to the system graphic. Each analog input object may be assigned a minim um of five graphic files, each with high/low limits for automatic selection and display of these graphics. As an example, a graphic representation of a thermometer would rise and fall in response to either the room tem perature or its deviation from the controlling setpoint. Analog output objects, when selected with the mouse, shall be displayed as a prompted dialog (text only) box. Selection for display type shall be individual for each object. Analog object values may be changed by selecting either the "increase" or "decrease" arrow in the analog object spinner box without using the keypad. Pressing the button on the right side of the analog object spinner box allows direct entry of an analog value and accesses various menus where the analog value may be used, such as trend logs.
5. Analog objects may also be assigned to a system graphic, where the color of the defined object changes based on the analog object's value. For example, graphical thermostat device served by a single control zone would change color with respect to the temperature of the zone or its deviation from setpoint. All editing and area assignment shall be created or modified online using simple icon tools.
6. A customized menu label (push-button) shall be used for display selection. Menu items on a display shall allow penetration to lower level displays or additional menus. Dynamic point information and menu label pushbuttons may be mixed on the same display to allow sub-displays to exist for each item. Each display may be protected from viewing unless operator has appropriate security level. A security level may be assigned to each display and system object. The menu label shall not appear on the graphic if the operator does not have the appropriate security level.
7. The BAS displays shall have the ability to link to content outside of the BAS system. Such content shall include but is not limited to: Launching external files in their native applications (for example, a Microsoft Word document) and launching a Web browser resolving to a specified Web address.
8. The BAS system shall have the ability to run multiple, concurrent displays windows showing continuously updated data.
9. Graphic items with custom geometry that offer both color gradient shading and variable opacity in scale to system variables and range setpoints (OmniGraphics). Ability to automatically resize to display (OmniZoom).

D. Password Protection

1. Provide security system that prevents unauthorized use unless operator is logged on. Access shall be limited to operator's assigned functions when user is logged on. This includes displays as outlined above.
2. Each operator's terminal shall provide security for a minimum of 200 users. Each user shall have an individual User ID, User Name, and Password. Entries are alphanumeric characters only and are case sensitive (except for User ID). User ID shall be 0-8 characters, User Name shall be 0-29 characters, and Password shall be 4-8 characters long. Each system user shall be allowed individual assignment of only those control functions, menu items, and user specific system start display, as well restricted access to discrete BACnet devices to which that user requires access. All passwords, user names, and access assignments shall be adjustable online at the operator's terminal. Users should have the capability to be assigned to specific user type "groups" that can share the same access levels to speed setup. Users who are members of multiple "groups" shall have the ability to activate/deactivate membership to those groups while using the BAS (without logout). Users shall

also have a set security level, which defines access to displays and individual objects the user may control. System shall include 10 separate and distinct security levels for assignment to users.

3. System shall include an Auto Logout Feature that shall automatically logout user when there has been no keyboard or mouse activity for a set period of time. Time period shall be adjustable by system administrator. Auto Logout may be enabled and disabled by system administrator. Operator terminal shall display message on screen that user is logged out after Auto Logout occurs.
4. The system shall permit the assignment of an effective date range, as well as an effective time of day, that the User IDs are permitted to authenticate.

E. Operator Activity Log

1. Operator Activity Log that tracks all operator changes and activities shall be included with system. System shall track what is changed in the system, who performed this change, date and time of system activity, and value of the change before and after operator activity. Operator shall be able to display all activity, sort the changes by user and also by operation. Operator shall be able to print the Operator Activity log display.
2. Log shall be gathered and archived to hard drive on operator's workstation as needed. Operator shall be able to export data for display and sorting in a spreadsheet.
3. Any displayed data that is changeable by the operator may be selected using the right mouse button and the operator activity log shall then be selectable on the screen. Selection of the operator activity log using this method shall show all operator changes of just that displayed data.

F. Scheduling

1. Operator's workstation shall show all information in easy-to-read daily format including calendar of this month and next. All schedules shall show actual ON/OFF times for day based on scheduling priority. Priority for scheduling shall be events, holidays and daily, with events being the highest.
2. Holiday and special event schedules shall display data in calendar format. Operator shall be able to schedule holidays and special events directly from these calendars.
3. Operator shall be able to change all information for a given weekly or exception schedule if logged on with the appropriate security access.
4. System shall include a Schedule Wizard for set up of schedules. Wizard shall walk user through all steps necessary for schedule generation. Wizard shall have its own pull-down selection for startup or may be started by right-clicking on value displayed on graphic and then selecting Schedule.
5. Scheduling shall include optimum start based on outside air temperature, current heating/cooling setpoints, indoor temperature and history of previous starts. Each and every individual zone shall have optimum start time independently calculated based on all parameters listed. User shall input schedules to set time that occupied setpoint is to be attained. Optimum start feature shall calculate the startup time needed to match zone temperature to setpoint. User shall be able to set a limit for the maximum startup time allowed.
6. Any displayed data that is changeable by the operator may be selected using the right mouse button and the schedule shall then be selectable on the screen. Selection of the schedule using this method shall allow the viewing of the assigned schedule or launch the Schedule Wizard to allow the point to be scheduled.

G. Alarm Indication and Handling.

1. Operator's workstation shall provide audible, visual, printed, and email means of alarm indication. The alarm dialog box shall always become the top dialog box regardless of the application(s) currently running. Printout of alarms shall be sent to the assigned terminal and port. Alarm notification can be filtered based on the User ID's authorization level.
2. System shall provide log of alarm messages. Alarm log shall be archived to the hard disk of the system operator's terminal. Each entry shall include a description of the event-initiating object generating the alarm. Description shall be an alarm message of at least 256 characters in length. Entry shall include time and date of alarm occurrence, time and date of object state return to

normal, time and date of alarm acknowledgment, and identification of operator acknowledging alarm.

3. Alarm messages shall be in user-definable text (English or other specified language) and shall be delivered either to the operator's terminal, client or through remote communication using email (Authenticated SMTP supported).
4. System shall include an Alarm Wizard for set up of alarms. Wizard shall walk user through all steps necessary for alarm generation. Wizard shall have its own pull- down selection for startup or may be started by right-clicking on value displayed on graphic and then selecting alarm setup.
5. Any displayed data that is changeable by the operator may be selected using the right mouse button and the alarm shall then be selectable on the screen. Selection of the alarm using this method shall allow the viewing of the alarm history or launch the Alarm Wizard to allow the creation of a new alarm.

H. Trendlog Information

1. System server shall periodically gather historically recorded data stored in the building controllers and store the information in the system database. Stored records shall be appended with new sample data, allowing records to be accumulated. Systems that write over stored records shall not be allowed unless limited file size is specified. System database shall be capable of storing up to 50 million records before needing to archive data. Samples may be viewed at the operator's workstation. Operator shall be able to view all trended records, both stored and archived. All trendlog records shall be displayed in standard engineering units.
2. Software that is capable of graphing the trend logged object data shall be included. Software shall be capable of creating two-axis (X, Y) graphs that display up to l0 object types at the same time in different colors. Graphs shall show object values relative to time. Each trendlog shall support a custom scale setting for the graph view that is to be stored continuously. System shall be capable of trending on an interval determined by a polling rate, or change-of-value.
3. Operator shall be able to change Trendlog setup information. This includes the information to be logged as well as the interval at which it is to be logged. All input, output, and value object types in the system may be logged. All operations shall be password protected. Setup and viewing may be accessed directly from any and all graphics on which object is displayed.
4. System shall include a Trend Wizard for setup of logs. Wizard shall walk user through all necessary steps. Wizard shall have its own pull-down selection for startup, or may be started by right-clicking on value displayed on graphic, and then selecting Trendlogs from the displayed menu.
5. System shall be capable of using Microsoft SQL as the system database.
6. Any displayed data that is changeable by the operator may be selected using the right mouse button and the trendlog shall then be selectable on the screen. Selection of the trendlog using this method shall allow the viewing of the trendlog view or launch the Trendlog wizard to allow the creation of a new trend.

I. Energy Log Information

1. System server shall be capable of periodically gathering energy log data stored in the field equipment and archive the information. Archive files shall be appended with new data, allowing data to be accumulated. Systems that write over archived data shall not be allowed unless limited file size is specified. Display all energy log information in standard engineering units.
2. All data shall be stored in database file format for direct use by third-party programs. Operation of system shall stay completely online during all graphing operations.
3. Operator shall be able to change the energy log setup information as well. This includes the meters to be logged, meter pulse value, and the type of energy units to be logged. All meters monitored by the system may be logged. System shall support using flow and temperature sensors for BTU monitoring.

4. System shall display archived data in tabular format form for both consumption and peak values. Data shall be shown in hourly, daily, weekly, monthly and yearly formats. In each format, the user shall be able to select a specific period of data to view.

J. Demand Limiting

1. System shall include demand limiting program that includes two types of load shedding. One type of load shedding shall shed/restore equipment in binary fashion based on energy usage when compared to shed and restore settings. The other type of shedding shall adjust operator selected control setpoints in an analog fashion based on energy usage when compared to shed and restore settings. Shedding may be implemented independently on each and every zone or piece of equipment connected to system.
2. Binary shedding shall include minimum of five (5) priority levels of equipment shedding. All loads in a given priority level shall be shed before any loads in a higher priority level are shed. Load shedding within a given priority level shall include two methods. In one, the loads shall be shed/restored in a "first off-first on" mode, and in the other the loads are just shed/restored in a "first off-last on" (linear) fashion.
3. Analog shed program shall generate a ramp that is independently used by each individual zone or individual control algorithm to raise the appropriate cooling setting and lower appropriate heating setting to reduce energy usage.
4. Status of each and every load shed program shall be capable of being displayed on every operator terminal connected to system. Status of each load assigned to an individual shed program shall be displayed along with English description of each load.

K. Tenant Activity

1. System shall include program that monitors after-hours overrides by tenants, logs that data, and generates a bill based on usage and rate charged for each tenant space. Tenant Activity program shall be able to assign multiple zones, from a list of every zone connected to system, to a particular tenant. Every zone is monitored for after-hour override usage and that data logged in server. Operator may then generate a bill based on the usage for each tenant and the rate charged for any overtime use.
2. Configuration shall include entry of the following information for use in logging and billing:

    a. Tenant's contact name and address
    b. One or multiple tenant zones that make up a total tenant space, including a separate billing rate for each separate zone
    c. Minimum and maxim um values an event duration and event limit
    d. Property management information
    e. Overall billing rate
    f. Seasonal adjustments or surcharge to billing rate
    g. Billing notification type such including, but not limited to printer, file and email
    h. Billing form template

3. Logging shall include recording the following information for each and every tenant event:

    a. Zone description
    b. Time the event begins
    c. Total override time
    d. Limits shall be applied to override time

4. A tenant bill shall be generated for a specific period using all the entered configuration data and the logged data. User with appropriate security level shall be able to view and override billing information. User shall be able to select a billing period to view and be able to delete events from billing and edit a selected tenant activity event's override time.

L. Reports

1. System server shall be capable of periodically producing reports of trendlogs, alarm history, tenant activities, device summary, energy logs, and override points. The frequency, content, and delivery are to be user adjustable.
2. All reports shall be capable of being delivered in multiple formats including text- and comma-separated value (CSV) files. The files can be printed, emailed, or saved to a folder, either on the server hard drive or on any network drive location.

M. Configuration/Setup

1. Provide means for operator to display and change system configuration. This shall include, but not be limited to, system time, day of the week, date of daylight savings set forward/set back, printer termination, port addresses, modem port and speed, etc. Items shall be modified using understandable terminology with simple mouse/cursor key movements.

N. Field Engineering Tools

1. Operator's workstation software shall include field engineering tools for programming all controllers supplied. All controllers shall be programmed using graphical tools that allow the user to connect function blocks on screen that provide sequencing of all control logic. Function blocks shall be represented by graphical displays that are easily identified and distinct from other types of blocks. Graphical programming that uses simple rectangles and squares is not acceptable.
2. User shall be able to select a graphical function block from menu and place on screen. Provide zoom in and zoom out capabilities. Function blocks shall be downloaded to controller without any reentry of data.
3. Programming tools shall include a real-time operation mode. Function blocks shall display real-time data and be animated to show status of data inputs and outputs when in real-time operation. Animation shall show change of status on logic devices and countdown of timer devices in graphical format
4. Field engineering tools shall also include a database manager of applications that include logic files for controllers and associated graphics. Operator shall be able to select unit type, input/output configuration and other items that define unit to be controlled. Supply minimum of 250 applications as part of workstation software.
5. Field engineering tool shall include Device Manager for detection of devices connected anywhere on the BACnet network by scanning of the entire network. This function shall display device instance, network identification, model number, and description of connected devices. It shall record and display software file loaded into each controller. *A* copy of each file shall be stored on the computer's hard drive. If needed, this file shall be downloaded to the appropriate controller using the mouse.
6. System shall automatically notify the user when a device that is not in the database is added to the network.
7. System shall include backup/restore function that will back up entire system to selected medium and then restore system from that media. The system shall be capable of creating a backup for the purpose of instantiating a new client PC.
8. The system shall provide a means to scan, detect, interrogate, and edit third-party BACnet devices and BACnet objects within those devices.

O. Workstation Hardware

1. Provide operator's workstation(s) at location(s) noted on the plans.
2. Workstation/server computer minimum requirements

    a. PC Processor of 2.5 GHz quad-core or better

b. 8 GB RAM or better
c. 1TB hard disk or better
d. High-performance graphics adapter
e. Ethernet 10/100 network interface card
f. Keyboard, monitor, mouse, USB port and CD-ROM
g. Microsoft Windows 8 or Windows 10
h. Monitor size shall be 22" minimum
i. Color printer (inkjet, color dye or laser)

P. Software

1. At the conclusion of project, contractor shall leave with owner a CD ROM that includes the complete software operation system and project graphics, setpoints, system parameters, etc. This backup shall allow the owner how to completely restore the system in the case of a computer malfunction.

2.2 GRAPHICAL USER INTERFACE

A. Display of Data

1. Graphics displays shall include animation of all Fans shall turn, pilot lights shall blink, coils shall change colors, and so on.
2. Real-time data shall be shown. This data must be directly gathered using the BACnet network and automatically updated without any user action.
3. It shall be possible for user to change data if the user is logged on with the appropriate password. Clicking on a button or typing in a new value shall change digital data. Using pull-down menus or typing in a new value shall change analog data.
4. Data displays shall be navigated using pushbuttons on the displays that are simply clicked on with the mouse to select a new display.

B. Time Schedule Adjustment

1. Logged in access shall allow user to view and edit all schedules in the system. This includes standard, holiday and event schedules as described in BAS specification. Display of schedules shall show interaction of all schedules on a single display so user sees an overview of how all work together. User shall be able to edit schedules from this display.
2. Display of all three schedules must show all ON times for standard, holiday and event schedules in different colors on a given day. In addition, OFF times for each must also be shown in additional colors. User shall be able to select from standard calendar what days are to be scheduled and same display shall show all points and zones affected. User shall be able to set time for one day and select all days of the week that shall be affected as a recurrence of that same schedule for that given day.
3. Schedule list shall show all schedules currently defined. This list shall include all standard, holiday and event schedules. In addition, user shall be able to select a list that shows all scheduled points and zones.

C. Logging of Information

1. User shall use standard browser technology to view all trendlogs in system. User shall be able to view logged data in tabular form or graphical format. User shall be able to adjust time interval of logged data viewed and shall be able to adjust Y axis of data viewed in graphical format. Data shall be in CSV format.

D. Alarm Handling

1. The front end shall display alarms as they occur. User shall be able to acknowledge alarms using browser technology. I n addition, user shall be able to view history of alarm occurrence over a user-selected time frame. In addition, those alarms may be filtered for viewing per user-selected options. A single selection shall display all alarms that have not been acknowledged.

E. BACnet Communication

1. The Alerton system shall directly communicate to all devices on the BAS network using BACnet protocol. No intermediate devices shall be necessary for BACnet communication.

2.3 BUILDING CONTROLLER

A. General Requirements

1. BACnet Conformance

a. Building Controller shall be approved by the BTL as meeting the BACnet Building Controller requirements.
b. Refer to section 22.2, BACnet Functional Groups, in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

2. Building controller shall be of modular construction such that various modules may be selected to fit the specific requirements of a given project. At a minim um, modules shall consist of a power supply module, a BACnet Ethernet-MS/TP (master slave token passing) module, a BACnet MS/TP-only module, and a modem module for telephone communication. Those projects that require special interfaces may use Modbus modules as needed. However, all Ethernet communications and all controllers-including central plant controllers, advanced application controllers and unitary controllers-supplied by BAS manufacturer shall utilize the BACnet protocol standard.
3. Modules shall be selected to fit the particular project application. Up to seven modules shall be powered by a single power supply module. All modules shall be panel-mounted on DIN rail for ease of addition and shall be interconnected using a simple plug-in cable. A module in the middle shall be replaceable without removing any other modules.
4. All modules shall be capable of providing global control strategies for the system based on information from any objects in the system, regardless if the object is directly monitored by the building controller module or by another controller. The software program implementing these strategies shall be completely flexible and user-definable. All software tools necessary for programming shall be provided as part of project software. Any systems utilizing factory pre-programmed global strategies that cannot be modified by field personnel on-site, using a WAN or downloaded through remote communications are not acceptable. Changing global strategies using firmware changes is also unacceptable.
5. Programming shall be object-oriented using control function blocks, and support DDC functions, 1000 Analog Values and 1000 Binary Values. All flowcharts shall be generated and automatically downloaded to controller. Programming tool shall be supplied and be resident on workstation. The same tool shall be used for all controllers.
6. Provide means to graphically view inputs and outputs to each program block in real- time as program is executing. This function may be performed using the operator's workstation or field computer.
7. Controller shall have sufficient memory to ensure high performance and data reliability. Battery shall provide power for orderly shutdown of controller and storage of data in nonvolatile flash memory. Battery backup shall maintain real-time clock functions for a minimum of 20 days.
8. Global control algorithms and automated control functions shall execute using 32- bit processor.
9. Schedules

a. Each building controller module shall support a minimum of 80 BACnet Schedule Objects and 80 BACnet Calendar Objects.
b. Building controller modules shall provide normal seven-day scheduling, holiday scheduling and event scheduling.

10. Logging Capabilities

a. Each building controller shall log as minim um 320 values. Any object in the system (real or calculated) may be logged. Sample time interval shall be adjustable at the operator's workstation.
b. Logs may be viewed both on-site or off-site using WAN or remote communication.
c. Building controller shall periodically upload trended data to networked operator's workstation for long-term archiving if desired.
d. Archived data stored in database format shall be available for use in third-party spreadsheet or database programs.

11. Alarm Generation

a. Alarms may be generated within the system for any object change of value or state (either real or calculated). This includes things such as analog object value changes, binary object state changes, and various controller communication failures.
b. Each alarm may be dialed out as noted elsewhere.
c. Alarm log shall be provided for alarm viewing. Log may be viewed on-site at the operator's terminal or off-site using remote communications.
d. Controller must be able to handle up to 320 alarm setups stored as BACnet event enrollment objects, with system destination and actions individually configurable.

12. Demand Limiting

a. Demand limiting of energy shall be a built-in, user-configurable function. Each controller module shall support shedding of up to 200 loads using a minimum of two types of shed programs.
b. Load shedding programs in building controller modules shall operate as defined in section 2.1.J of this specification.

13. Tenant Activity Logging

a. Tenant Activity logging shall be supported by building controller module. Each independent module shall support a minimum of 80 zones.
b. Tenant Activity logging shall function as defined in section 2.1.K of this specification.

B. Ethernet - MS/TP Module

1. Ethernet - MS/TP Module shall support every function as listed under paragraph A, General Requirements, of this section and the following.
2. All communication with operator's workstation and all application controllers shall be through BACnet. Building controller Ethernet - MS/TP module shall incorporate as a minimum, the functions of a 2-way BACnet router. Controller shall route BACnet messages between the high-speed LAN (Ethernet 10/lOOM Hz) and MS/TP LAN. Ethernet - MS/TP module shall also route messages from all other building controller modules onto the BACnet Ethernet network.

a. MS/TP LAN must be software-configurable from 9.6 to 76.8Kbps.
b. The RJ-45 Ethernet connection must accept either 10Base-T or 100Base-TX BACnet over twisted pair cable (UTP).

3. BACnet Conformance

a. Ethernet - MS/TP module shall, as a minimum, support MS/TP and Ethernet BACnet LAN types. It shall communicate directly using these BACnet LANs as a native BACnet device and shall support simultaneous routing functions between all supported LAN types. Global controller shall be approved by the BACnet Testing Laboratory (BTL) as meeting the BACnet Building Controller requirements.
b. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
c. The building controller shall comply with Annex J of the BACnet specification for IP connections. This device shall use Ethernet to connect to the IP internetwork, while using the same Ethernet LAN for non-I P communications to other BACnet devices on the LAN. Must support interoperability on WANs and CANs and function as a BACnet Broadcast Management Device (BBMD).

C. MS/TP Module

1. MS/TP Module shall support every function as listed under paragraph A, General Requirements, of this section and the following:

a. Building controller MS/TP module communications shall be though BACnet MS/TP LAN to all advanced application and application-specific controllers. MS/TP module shall also route messages to Ethernet - MS/TP module for communication over WAN.
b. MS/TP LAN must be software configurable from 9.6 to 76.8Kbps.
c. Configuration shall be through RS-232 connection.

2. BACnet Conformance

a. MS/TP module shall be approved by the BTL (BACnet Testing Laboratory) as meeting the BACnet Building Controller requirements. MS/TP module shall as a minimum support MS/TP BACnet LAN type. It shall communicate directly using this BACnet LAN as a native BACnet device and shall support simultaneous routing functions between all supported LAN types.
b. Standard BACnet object types supported shall include, as a minimum, Analog Value, Binary Value, Calendar, Device, File, Group, Notification Class, Program, and Schedule object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

D. Power Supply Module

1. Power supply module shall power up to seven building controller modules. Input for power shall accept between 17-30VAC, 47-65Hz.
2. Power supply module shall include rechargeable battery for orderly shutdown of controller modules including storage of all data in flash memory and for continuous operation of real-time clocks for minimum of 20 days.

2.4 AIR HANDLER APPLICATION CONTROLLERS

A. Provide one or more native BACnet application controllers for each air handler and provide native BACnet application controllers as needed for central plant control that adequately cover all objects listed in object list. All controllers shall interface to building controller through either MS/TP LAN using BACnet protocol, or Ethernet LAN using BACnet over Ethernet or BACnet

TCP/IP. No gateways shall be used. Controllers shall include input, output and self-contained logic program as needed for complete control of units. Controllers shall be fully programmable using graphical programming blocks. Programming tool shall be resident on operator workstation and be the same tool as used for the building controller. No auxiliary or non-BACnet controllers shall be used.

A. BACnet Conformance

1. Application controllers shall be approved by the BTL as meeting the BACnet Advanced Application Controller requirements.
2. Refer to section 22.2, BACnet Functional Groups, in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
3. Standard BACnet object types supported shall include, as a minim um, Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Binary Value, Multi-state Values, Device, File, and Program object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

B. Application controllers shall include universal inputs with 12-bit resolution that accept 3K and 10K thermistors, 0-10VDC, Platinum 1000 ohm RTD, 0-SVDC, 4-20mA and dry contact signals. Any input on a controller may be either analog or digital with a minimum of three inputs that accept pulses. Controller shall also include support and modifiable programming for interface to intelligent room sensor with digital display. Controller shall include binary and analog outputs on board. Analog outputs with 12-bit resolution shall support either 0-10VDC or 0-20mA. Binary outputs shall have LED indication of status. Software shall include scaling features for analog outputs.

1. Application controller shall include 20VDC voltage supply for use as power supply to external sensors.
2. All outputs must have onboard Hand-Off-Auto (HOA) switches and a status indicator light. HOA switch position shall be monitored. Each analog output shall include a potentiometer for manually adjusting the output when the HOA switch is in the Hand position.
3. The position of each HOA switch shall be available system wide as a BACnet object property.

C. All program sequences shall be stored on board application controller in EEPROM. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller up to 20 times per second (minimum of 10 times per second) and capable of multiple PID loops for control of multiple devices. All calculations shall be completed using floating-point math and system shall support display of all information in floating-point nomenclature at operator's terminal.

1. The following control blocks shall be supported:

    a. Natural Log
    b. Exponential
    c. Log base 10
    d. X to the power of Y
    e. Nth square root of X
    f. f. 5th Order Polynomial Equations
    g. Astronomical Clock (sunrise/sunset calculation)
    h. Time based schedules

D. Programming of application controller shall be completely modifiable in the field over installed BACnet LANs or remotely using modem interface. Operator shall program logic sequences by graphically moving

function blocks on screen and tying blocks together on screen. Application controller shall be programmed using programming tools as described in operator's terminal section.

E. Application controller shall include support for intelligent room sensor (see Section 2.10.B.) Display on intelligent room sensor shall be programmable at application controller and include an operating mode and a field service mode. All button functions and display data shall be programmable to show specific controller data in each mode, based on which button is pressed on the sensor. See sequence of operation for specific display requirements at intelligent room sensor.

F. Schedules:

1. The controller shall support a minimum of 3 BACnet Schedule Objects and have a real time clock on board with battery backup to maintain time through a power loss.

G. Logging Capabilities:

1. Controller shall support a minimum of 50 trendlogs. Any object in the controller (real or calculated) may be logged. Sample time interval shall be adjustable at the operator's workstation.
2. Controller shall periodically upload trended data to system server for long-term archiving if desired. Archived data stored in (MS Jet Database or SQL) database form and shall be available for use in third-party spreadsheet or database programs.

H. Alarm Generation:

1. Alarms may be generated within the controller for any object change of value or state (either real or calculated). This includes things such as analog object value changes, and binary object state changes.
2. Alarm log shall be provided for alarm viewing. Log may be viewed on-site at the operator's terminal or off-site using remote communications.
3. Controller must be able to handle up to 25 alarm setups stored as BACnet event enrollment objects, with system destination and actions individually configurable.

I. The controller processor shall be a 32-bit processor.

J. The packaging of the controller shall provide operable doors to cover the terminals once installation is complete. The housing of the controller shall provide for DIN rail mounting and also fully enclose circuit board.

2.5 TERMINAL UNIT APPLICATION CONTROLLERS (FAN-COILS)

A. Provide one native BACnet application controller for each piece of unitary mechanical equipment that adequately covers all objects listed in object list for unit. All controllers shall interface to building controller through MS/TP LAN using BACnet protocol. No gateways shall be used. Controllers shall include input, output and self-contained logic program as needed for complete control of unit.

B. BACnet Conformance

1. Application controllers shall, as a minim um, support MS/TP BACnet LAN types. They shall communicate directly using this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as a native BACnet device. Application controllers shall be approved by the BTL as meeting the BACnet Application Specific Controller requirements and support all BACnet services necessary to provide the following BACnet functional groups:

a. Files Functional Group.

b. Reinitialize Functional Group.
c. Device Communications Functional Group.

2. Please refer to Section 22.2, BACnet Functional Groups in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
3. Standard BACnet object types supported shall include, as a minimum, Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Binary Value, Device, File, and Program Object Types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

C. Application controllers shall include universal inputs with 10-bit resolution that can accept 3K and lOK thermistors, 0-5VDC, 4-20mA, dry contact signals and a minim um of 3 pulse inputs. Any input on controller may be either analog or digital. Controller shall also include support and modifiable programming for interface to intelligent room sensor. Controller shall include binary outputs on board with analog outputs as needed.

D. All program sequences shall be stored on board controller in EEPROM. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller 10 times per second and shall be capable of multiple PID loops for control of multiple devices. Programming of application controller shall be completely modifiable in the field over installed BACnet LANs or remotely through modem interface. Operator shall program logic sequences by graphically moving function blocks on screen and tying blocks together on screen. Application controller shall be programmed using same programming tools as building controller and as described in operator workstation section. All programming tools shall be provided and installed as part of system.

E. Application controller shall include support for intelligent room sensor. Display on room sensor shall be programmable at controller and include an operating mode and a field service mode. All button functions and display data shall be programmable to show specific controller data in each mode based on which button is pressed on the sensor. See sequence of operation for specific display requirements at intelligent room sensor.

2.6 VAV BOX CONTROLLERS- SINGLE DUCT WITH HOT WATER REHEAT

A. Provide one native BACnet application controller for each VAV box that adequately covers all objects listed in object list for unit. All controllers shall interface to building controller through MS/TP LAN using BACnet protocol. No gateways shall be used. Controllers shall include on board CFM flow sensor, inputs, outputs and programmable, self-contained logic program as needed for control of units.

B. BACnet Conformance

1. Application controllers shall, at a minimum, support MS/TP BACnet LAN types. They shall communicate directly through this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as a native BACnet device. Application controllers shall be approved by the BTL as meeting the BACnet Application Specific Controller requirements.
2. Please refer to Section 22.2, BACnet Functional Groups, in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
3. Standard BACnet object types supported shall include, as a minimum, Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Binary Value, Device, File, and Program Object Types.

All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

C. Application controllers shall include universal inputs with 10-bit resolution that can accept 3K and lOK thermistors, 0-5 VDC, and dry contact signals. Inputs on controller may be either analog or digital. Controller shall also include support and modifiable programming for interface to intelligent room sensor with digital display. Controller shall also include binary outputs on board. For applications using variable speed parallel fans, provide a single analog output selectable for 0-10 V or 0-20 mA control signals. Application controller shall include microprocessor driven flow sensor for use in pressure independent control logic. All boxes shall be controlled using pressure- independent control algorithms and all flow readings shall be in CFM (LPS if metric).

D. All program sequences shall be stored on board application controller in EEPROM. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller 10 times per second and shall be capable of multiple PIO loops for control of multiple devices. Programming of application controller shall be completely modifiable in the field over installed BACnet LANs or remotely using modem interface. Operator shall program logic sequences by graphically moving function blocks on screen and tying blocks together on screen. Application controller shall be programmed using the same programming tool as Building Controller and as described in operator's workstation section. All programming tools shall be provided as part of system.

E. Application controller shall include support for intelligent room sensor. Display on room sensor shall be programmable at application controller and include an operating mode and a field service mode. All button functions and display data shall be programmable to show specific controller data in each mode based on which button is pressed on the sensor. See sequence of operations for specific display requirements for intelligent room sensor.

F. On board flow sensor shall be microprocessor-driven and pre-calibrated at the factory. Pre-calibration shall be at 16 flow points as a minimum. All factory calibration data shall be stored in non-volatile memory. Calibration data shall be field adjustable to compensate for variations in VAV box type and installation. All calibration parameters shall be adjustable through intelligent room sensor. Operator's workstation, portable computers, and special hand-held field tools shall not be needed for field calibration.

G. Provide duct temperature sensor at discharge of each VAV box that is connected to controller for reporting back to operator's workstation.

2.7 AUXILIARY CONTROL DEVICES

A. Temperature Sensors

B. All temperature sensors to be solid-state electronic, interchangeable with housing appropriate for application. Wall sensors to be installed as indicated on drawings. Mount 48 inches above finished floor. Duct sensors to be installed such that the sensing element is in the main air stream. Immersion sensors to be installed in wells provided by control contractor, but installed by mechanical contractor. Immersion wells shall be filled with thermal compound before installation of immersion sensors. Outside air sensors shall be installed away from exhaust or relief vents, not in an outside air intake, and in a location that is in the shade most of the day.

C. Intelligent Room Sensor with LCD Readout

1. All room sensors shall be a combination temperature and humidity sensor and integrated Co2 where shown on the floor plans. The sensor shall contain a backlit LCD digital display and user function keys along with temperature sensor. Controller shall function as room control unit, and shall allow

occupant to raise and lower setpoint, and activate terminal unit for override use-all within limits as programmed by building operator. Sensor shall also allow service technician access to hidden functions as described in sequence of operation.

2. Override time may be set and viewed in half-hour increments. Override time countdown shall be automatic, but may be reset to zero by occupant from the sensor. Time remaining shall be displayed. Display shall show the word "OFF" in unoccupied mode unless a function button is pressed.
3. See sequence of operation for specific operation of LCD displays and function keys in field service mode and in normal occupant mode. Provide intelligent room sensors as specified in point list.
4. Field service mode shall be customizable to fit different applications. If intelligent room sensor is connected to VAV controller, VAV box shall be balanced and all air flow parameters shall be viewed and set from the intelligent room sensor with no computer or other field service tool needed.

D. Wall Sensor

1. Standard wall sensor shall use solid-state sensor identical to intelligent room sensor and shall be packaged in aesthetically pleasing enclosure. Sensor shall provide override function, warmer/cooler lever for set point adjustment and port for plug-in of Field Service Tool for field adjustments. Override time shall be stored in controller and be adjustable on a zone-by-zone basis. Adjustment range for warmer/cooler lever shall also be stored in EEPROM on controller. All programmable variables shall be available to field service tool through wall sensor port.

E. Wireless Wall Sensor

1. Wireless wall sensor shall use solid-state sensor and shall be packaged in aesthetically pleasing enclosure. Sensor shall provide override function, warmer/cooler dial for set point adjustment. Override time shall be stored in controller and be adjustable on a zone-by-zone basis. Adjustment range for warmer/cooler lever shall also be stored in EEPROM on controller. All programmable variables shall be available to field service tool through wall sensor port. There shall be a mechanical means to lock the wall sensor to the base to prevent theft and vandalism.
2. Wireless wall sensor shall have a battery life of 5 year with alkaline batteries and 7.5 years with lithium batteries. A low battery indication shall be signaled to the controller prior to the battery being exhausted. The wireless sensor shall run on industry standard AA style batteries.
3. The wireless range in open air shall meet or exceed 300 ft. The strength of the wireless signal must be indicated at the wireless sensor to aid in placement and trouble shooting. The receiver shall have a wireless-communications-received light that indicates the proper communication is occurring.
4. The wireless wall sensor and receiver must be paired in an addressable mean to facilitate easy replacement and reassignment.

F. Airflow Control:

1. Where indicated, provide airflow measuring stations and control. Refer to Section 237213, “Custom Air Handling Units," and control diagrams on Drawings.
2. A factory-furnished and calibrated controller shall be programmed, in nonvolatile EPROM, with application-specific airflow set point and range.
3. The controller and actuator shall communicate to control the desired airflow.
4. The controller shall receive a zero- to 10-V de input signal and report a zero- to 20- mA output signal that is proportional to the airflow.
5. Airflow measurement and control range shall be suitable for operation between 150 to 2000 fpm (0.8 to 10 m/s).
6. Ambient Operating Temperature Range: Minus 40 to plus 140 deg F (Minus 40 to plus 60 deg C).
7. Ambient Operating Humidity Range: 5 to 95 percent relative humidity, non- condensing.
8. Provide unit with control transformer rated for not less than 85 VA. Provide transformer with primary and secondary protection and primary disconnecting means. Coordinate requirements with field power connection.
9. Provide screw terminals for interface to field wiring.

10. Factory mount electronics within a NEMA 250, Type 1painted steel enclosure.

2.8 THERMAL ENERGY METERS

A. Performance Requirements: Manufacturer shall certify that each energy meter indicated complies with specified performance requirements and characteristics.

1. Product certificates are required.
2. Insertion-Type Thermal Energy Meters:

a. Manufacturer: Subject to compliance with requirements, provide products by the following:

1) ONICON Incorporated Turbine Flow Meter Model F-1210 and BTU Meter Model System-10-BAC.

b. Description:

1) Factory-packaged meter consisting of supply and return temperature sensors, flow sensor, digital display, keypad user interface, installation hardware, color-coded interconnecting cabling, and installation instructions.
2) Each thermal energy meter shall be individually calibrated and provided with calibration certification traceable to NIST.

c. Alphanumeric display of the following on face of enclosure:

1) Total energy consumption.
2) Energy rate.
3) Flow rate.
4) Supply temperature.
5) Return temperature.
6) Visual indication of power status (on/off) on face of enclosure.

d. Electronics Enclosure:

1) Remote from temperature and flow sensors.
2) NEMA 250, Type 12 or Type 13 for indoor applications and NEMA 250, Type 4 or Type 4X for outdoor applications.
3) Labeled terminal strip for field wiring connections.

e. Programming:

1) Factory programmed for specific application and field programmable through keypad on face of enclosure.
2) Programmed parameters and total energy consumption shall be stored in non-volatile EEPROM memory.

f. Output Signals:

1) Total Energy Consumption: Isolated solid-state dry contact with 100 mA, 50-V rating and contact duration of 0.5, 1, 2, or 6 seconds.
2) Energy Rate, Flow Rate, Supply Temperature, Return Temperature: 4 to 20 mA or zero- to 10-V de for each.

g. Temperature Sensors:

1) Temperature range matched to application.
2) Temperature accuracy within 0.15 deg F (0.08 deg C) over the calibrated range.
3) Stainless-steel or brass thermowell with NPS 1/2 (DN 15) N PT connection for each sensor.

h. Current Sensors:

1) Veris Model H-908 or equal.

i. Differential Pressure Transmitters & Switches:

1) Duct Static Pressure shall be Dwyer Model MS2-D102 or equal.
2) Space Static Pressure shall be Dwyer Model MS2-Wlll or equal.
3) Hydronic Differential Pressure shall be Dwyer Model 629-05-CH-P2-E5- 51-3V or equal.
4) Filter Switches shall be Dwyer Model ADPS-04-1-N or equal.

2.9 ELECTRONIC ACTUATORS AND VALVES

A. Quality Assurance for Actuators and Valves

1. UL Listed Standard 873 and C.S.A. Class 4813 02 certified.
2. NEMA 2 rated enclosures for inside mounting, provide with weather shield for outside mou nting.
3. Five-year manufacturer's warranty. Two-year unconditional and three-year product defect from date of installation.

B. Execution Details for Actuators and Valves

1. Furnish a Freeze-stat and install "Hard Wire" interlock to disconnect the mechanical spring return actuator power circuit for fail-safe operation. Use of the control signal to drive the actuators closed is not acceptable.
2. Each DOC analog output point shall have an actuator feedback signal, independent of control signal, wired and terminated in the control panel for true position information and troubleshooting. Or the actuator feedback signal may be wired to the DOC as an analog input for true actuator position status.
3. VAV box damper actuation shall be floating type or analog (2-lOVDC, 4-20mA).
4. Booster-heat valve actuation shall be floating type or analog (2-lOvdc, 4-20ma).
5. Primary valve control shall be analog (2-lOVDC, 4-20mA).

C. Actuators for damper and control valves 0.5-6 inches shall be electric unless otherwise specified, provide actuators as follows:

1. UL Listed Standard 873 and Canadian Standards Association Class 481302 shall certify actuators.
2. NEMA 2 rated actuator enclosures for inside mounting. Use additional weather shield to protect actuator when mounted outside.
3. Five-year manufacturer's warranty. Two-year unconditional and Three year product defect from date of installation.
4. Mechanical spring shall be provided when specified. Capacitors or other non-mechanical forms of fail-safe are not acceptable.
5. Position indicator device shall be installed and made visible to the exposed side of the actuator. For damper short shaft mounting, a separate indicator shall be provided to the exposed side of the actuator.

6. Overload Protection: Actuators shall provide protection against actuator burnout by using an internal current limiting circuit or digital motor rotation sensing circuit. Circuit shall insure that actuators cannot burn out due to stalled damper or mechanical and electrical paralleling. End switches to deactivate the actuator at the end of rotation are acceptable only for butterfly valve actuators.
7. A Pushbutton gearbox release shall be provided for all non-spring actuators.
8. Modulating actuators shall be 24VAC and consume lOVA power or less.
9. Conduit connectors are required when specified and when required by code.

D. Damper Actuators:

1. Outside air and exhaust air damper actuators shall be mechanical spring return. Capacitors or other non-mechanical forms of fail-safe are not acceptable. The actuator mounting arrangement and spring return feature shall permit normally open or normally closed positions of the damper as required.
2. Economizer actuators shall utilize analog control 2-lOVDC, floating control is not acceptable.
3. Electric damper actuators (including VAV box actuators) shall be direct shaft- mounted and use a V-bolt and toothed V-clamp causing a cold weld effect for positive gripping. Single bolt or set-screw type fasteners are not acceptable.
4. One electronic actuator shall be direct shaft-mounted per damper section. No connecting rods or jackshafts shall be needed. Small outside air and return air economizer dampers may be mechanically linked together if one actuator has sufficient torque to drive both and damper drive shafts are both horizontal installed.
5. Multi-section dampers with electric actuators shall be arranged so that each damper section operates individually. One electronic actuator shall be direct shaft-mounted per damper section. (See below execution section for more installation details.)

E. Valve Actuators 0.5-6 inches

1. Mechanical spring shall be provided on all actuators for pre-heat coil and actuators for AHU heating or cooling coil when units are mounted outside. See plans for fail- safe flow function: Normal Open or Normal Closed. Capacitors or other non-mechanical forms of fail-safe are not acceptable.
2. All zone service actuators shall be non-spring return unless otherwise specified.
3. The valve actuator shall be capable of providing the minimum torque required for proper valve close-off for the required application.
4. All control valves actuators shall have an attached 3-foot cable for easy installation to a junction box.
5. Override handle and gearbox release shall be provided for all non-spring return valve actuators.

F. Control Valves 0.5-6 inches

1. The BAS contractor shall furnish all specified motorized control valves and actuators. BAS contractor shall furnish all control wiring to actuators. The contractor shall install all valves. Equal percentage control characteristic shall be provided for all water coil control valves. Linear valve characteristic is acceptable for 3-way valves that are 2.5 inches and above.
2. Characterized control valves shall be used for hydronic heating or cooling applications and small to medium AHU water-coil applications to 200 GPM. Cooling tower coil control valves shall be for water-coil applications up to 550 GPM Actuators are non-spring return for terminal unit coil control unless otherwise noted. If the coil is exposed to the outside air stream, see plans for spring return requirement.

    a. Leakage is aero percent, close-off is 200psi, maximum differential is 30psi; rangeability is 500:1.
    b. Valves 0.5-2 inches shall be nickel-plated forged brass body, NPT screw type connections.
    c. Valves 0.5-1.25 inches shall be rated for ANSI Class 600 working pressure. Valves over 1.5 inches shall be rated for ANSI Class 400 working pressure. Two- position control valves shall be line size.

d. The operating temperature range shall be 0-250 degrees F.
e. Stainless steel ball and stem shall be furnished on all modulating valves.
f. Seats shall be fiberglass reinforced Teflon.
g. Two-way and three-way valves shall have an equal percentage control port. Full stem rotation is required for maximum flow to insure stable BTU control of the coil.
h. Three-way valve shall be applicable for both mixing and diverting.
i. The characterizing disc is made of TEFZEL and shall be keyed and held secure by a retaining ring.
j. The valves shall have a blow-out proof stem design.
k. The stem packing shall consist of 2 lubricated 0-rings designed for on-off or modulating service and require no maintenance.
l. The valves shall have an ISO type, 4-bolt flange for mou nting actuator in any orientation parallel or perpendicular to the pipe.
m. A non-metallic thermal isolation adapter shall separate valve flange from actuator.
n. One fastening screw shall secure the direct coupling of the thermal isolation adapter between the actuator and the valve. This will prevent all lateral or rotational forces from affecting the stem and its packing 0-rings.

3. Globe valves 0.5-2 inches shall be single port, top or bottom guided plug control or water flow applications.

a. Valves shall be bronze body, NPT screw type, and shall be rated for ANSI Class 250 working pressure.
b. Valves 0.5 inches (DN15) through 2 inches (DN50) with spring return actuators shall close off against 50 psi pressure differential with Class III leakage (0.1%).
c. The operating temperature range shall be 20-280 degrees F.
d. Spring loaded TFE packing shall protect against leakage at the stem.
e. Two-way valves shall have an equal percentage control port.
f. Three-way valves shall have a linear control and bypass port.
g. Mixing and diverting valves must be installed specific to the valve design.

4. Globe Valve 2.5-6 inches

a. Valves 2.5 inches (DN65) through 6 inches (DN50) shall be iron body, 125 lb. flanged with Class III (0.1%) close-off leakage at 50 psi differential.
b. Valves with spring return actuators shall close off against 50 psi pressure differential with Class III leakage (0.1%).
c. Flow type for two-way valves shall be equal percentage. Flow type for three-way valves shall be linear.
d. Mixing and diverting valves must be installed specific to the valve design.

G. Butterfly valves

1. Butterfly valves shall be sized for modulating service at 60-70 degree stem rotation. Isolation valves shall be line-size. Design velocity shall be less than 12 feet per second when used with standard EPDM seats.

a. Body is cast iron.
b. Disc is aluminum bronze standard.
c. Seat is EPDM standard.
d. Body Pressure is 200 psi, -30-275 degrees F.
e. Flange is ANSI 125/250.
f. Media Temperature Range is -22-240 degree F.
g. Maximum Differential Pressure is 200 psi for 2- to 6- inch size.

H. Butterfly Valve Industrial Actuators

1. Actuators shall be approved under Canadian Standards Association or other Nationally Recognized Testing Laboratory to UL standards. CSA Class 4813 02 or equal. Enclosure shall be NEMA 4 (weatherproof) enclosure and will have an industrial quality coating.

    a. Actuator shall have a motor rated for continuous duty. The motor shall be fractional horsepower; permanent split capacitor type designed to operate on a 120VAC, lpH, 60Hz supply. Two adjustable cam-actuated end travel limit switches shall be provided to control direction of travel. A self-resetting thermal switch shall be imbedded in the motor for overload protection.
    b. Reduction gearing shall be designed to withstand the actual motor stall torque. Gears shall be hardened alloy steel, permanently lubricated. A self-locking gear assembly or a brake shall be supplied.
    c. Actuator shall have a 6 ft wiring harness provided for ease in field wiring (above 1500 in-lbs). Two adjustable SPDT cam-actuated auxiliary switches, rated at 250VAC shall be provided for indication of open and closed position. Actuator shall have heater and thermostat to minimize condensation within the actuator housing.
    d. Actuator shall be equipped with a hand wheel for manual override to permit operation of the valve in the event of electrical power failure or system malfunction. Hand wheel must be permanently attached to the actuator and when in manual operation electrical power to the actuator will be permanently interrupted. The hand wheel will not rotate while the actuator is electrically driven.
    e. The actuator shall be analog, floating, or two position as called out in the control sequence of operation. All Analog valves shall be positive positioning, and respond to a 2-lOVDC, 4-20mA, or adjustable signal as required. Analog actuators shall have a digital control card allowing any voltage input for control and any DC voltage feedback signal for position indication.

2. Performance Verification Test

    a. Control loops shall cause productive actuation with each movement of the actuator and actuators shall modulate at a rate that is stable and responsive. Actuator movement shall not occur before the effects of previous movement have affected the sensor.
    b. Actuator shall have capability of signaling a trouble alarm when the actuator Stop-Go Ratio exceeds 30%.

3. Actuator mounting for damper and valve arrangements shall comply with the following:

    a. Damper actuators: Shall not be installed in the air stream
    b. A weather shield shall be used if actuators are located outside. For damper actuators, use clear plastic enclosure.
    c. Damper or valve actuator ambient temperature shall not exceed 122 degrees F through any combination of medium temperature or surrounding air. Appropriate air gaps, thermal isolation washers or spacers, standoff legs, or insulation shall be provided as necessary.
    d. Actuator cords or conduit shall incorporate a drip leg if condensation is possible. Water shall not be allowed to contact actuator or internal parts. Location of conduits in temperatures dropping below dew point shall be avoided to prevent water from condensing in conduit and running into actuator.

4. Damper mounting arrangements shall comply with the following:

    a. The contractor shall furnish and install damper channel supports and sheet metal collars.
    b. No jack shafting of damper sections shall be allowed.

c. Multi-section dampers shall be arranged so that each damper section operates individually. One electronic actuator shall be direct shaft mounted per section.

5. Valve Sizing for Water Coil

a. Modulating control valve body size may be reduced, at most, two pipe sizes from the line size or not less than half the pipe size. The BAS contractor shall size all water coil control valves for the application as follows:

1) Booster-heat valves shall be sized not to exceed 4-9psi differential pressure. Size valve for 50% valve authority. Valve design pressure drop is equal to the sum of coil drop plus the balance valve drop.
2) Primary valves shall be sized not to exceed 5-15psi differential pressure. Size valve for 50% valve authority. Valve design pressu re drop is equal to the sum of coil drop plus the bala nce valve drop.
3) Butterfly valves shall be sized for modulating service at 60-70 degree rotation. Design velocity shall be 12 feet per second or less when used with standard EPDM seats.

b. Valve mounting arrangements shall comply to the following:

1) Unions shall be provided on all ports of two-way and three-way valves.
2) Install three-way equal percentage characterized control valves in a mixing configuration with the "A" port piped to the coil.
3) Install 2.5 inches and above, three-way globe valves, as manufactured for mixing or diverting service to the coil.

2.10 CONTROL PANELS

A. All controllers, power supplies and relays shall be mounted in enclosures.

B. Enclosures may be NEMA 1when located in a clean, dry, indoor environment. Indoor enclosures shall be NEMA 12 when installed in other than a clean environment.

C. Enclosures shall have hinged, locking doors.

D. Provide laminated plastic nameplates for all enclosures in any mechanical room or electrical room. Include location and unit served on nameplate. Laminated plastic shall be 0.125 inches thick and appropriately sized to make label easy to read.

E. Control panels must be assembled by a UL authorized fabricator in accordance with UL508A standards and labeled with separate UL label numbers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence.

B. Notify the owner's representative in writing of conditions detrimental to the proper and timely completion of the work

C. Do not begin work until all unsatisfactory conditions are resolved.

3.2 INSTALLATION (GENERAL)

A. Install in accordance with manufacturer's instructions.

A. Provide all miscellaneous devices, hardware, software, interconnections, installation, and programming required to ensure a complete operating system in accordance with the sequences of operation and point schedules.

3.3 LOCATION AND INSTALLATION OF COMPONENTS

A. Locate and install components for easy accessibility; in general, mount 48 inches above floor with minimum 3 feet of clear access space in front of units. Obtain approval on locations from owner's representative prior to installation.

B. All instruments, switches, transmitters, etc., shall be suitably wired and mounted to protect them from vibration, moisture, and high or low temperatures.

C. Identify all equipment and panels. Provide permanently mounted tags for all panels.

D. Provide stainless steel or brass thermowells suitable for respective application and for installation under other sections, and sized to suit pipe diameter without restricting flow.

3.4 INTERLOCKING AND CONTROL WIRING

A. Provide all interlock and control wiring. All wiring shall be installed neatly and professionally, in accordance with Specification Division 16 and all national, state and local electrical codes.

B. Provide wiring as required by functions as specified and as recommended by equipment manufacturers, to serve specified control functions. Provide shielded low capacitance wire for all communications trunks.

C. Control wiring shall not be installed in power circuit raceways. Magnetic starters and disconnect switches shall not be used as junction boxes. Provide auxiliary junction boxes as required. Coordinate location and arrangement of all control equipment with the owner's representative prior to rough-in.

D. Provide auxiliary pilot duty relays on motor starters as required for control function.

E. Provide power for all control components from nearest electrical control panel or as indicated on the electrical drawings; coordinate with electrical contractor.

F. All control wiring in the mechanical, electrical, telephone and boiler rooms to be installed in raceways. All other wiring to be installed neatly and inconspicuously per local code requirements. If local code allows, control wiring above accessible ceiling spaces may be run with plenum-rated cable (without conduit).

3.5 DDC OBJECT TYPE SUMMARY

A. Provide all database generation.

B. Displays

1. System displays shall show all analog and binary object types within the system.They shall be logically laid out for easy use by the owner. Provide outside air temperature indication on all system displays associated with economizer cycles.

C. Run Time Totalization

1. At a minimum, run time totalization shall be incorporated for each monitored supply fan, return fan, exhaust fan, hot water and chilled water pumps. Warning limits for each point shall be entered for alarm and or maintenance purposes.

D. Trendlog

1. All binary and analog object types (including zones) shall have the capability to be automatically trended.

E. Alarm

1. All analog inputs (High/Low Limits) and selected binary input alarm points shall be prioritized and routed (locally or remotely) with alarm message per owner's requirements.

F. Database Save

1. Provide backup database for all standalone application controllers on disk.

3.6 FIELD SERVICES

A. Prepare and start logic control system under provisions of this section.

B. Start up and commission systems. Allow sufficient time for startup and commissioning prior to placing control systems in permanent operation.

C. Provide the capability for off-site monitoring at control contractor's local or main office. At a minim um, off-site facility shall be capable of system diagnostics and software download. Owner shall provide phone line for this service for one year or as specified.

D. Provide owner's representative with spare parts list. Identify equipment critical to maintaining the integrity of the operating system.

3.7 AS-BUILT DOCUMENTATION REQUIRED

A. Complete set of accurate control drawings and programming.

3.8 TRAINING

A. Provide application engineer to instruct owner in operation of systems and equipment.

B. Provide system operator's training to include (but not be limited to) such items as the following: modification of data displays, alarm and status descriptors, requesting data, execution of commands and request of logs. Provide this training to a minimum of three persons.

C. Provide on-site training above as required, up to 16 hours as part of this contract.

D. Provide tuition for at least two individuals to attend for a two-day factory training class.

E. If applicable, costs for travel, lodging and meals will be the responsibility of the owner.

3.9 DEMONSTRATION

A. Demonstrate complete operating system to owner's representative.

B. Provide certificate stating that control system has been tested and adjusted for proper operation.

END OF SECTION 230923

SECTION 22 11 23 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Manual gas shutoff valves.
5. Earthquake valves.
6. Pressure regulators.
7. Dielectric fittings.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Piping specialties.
2. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
3. Pressure regulators. Indicate pressure ratings and capacities.
4. Dielectric fittings.

B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

1. Shop Drawing Scale: 1/4 inch per foot.
2. Detail mounting, supports, and valve arrangements for service meter assembly and pressure regulator assembly.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved. Refer to Section 23 00 50, “Common Work Results for HVAC Systems for additional requirements.

B. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.

C. Qualification Data: For qualified professional engineer.

D. Welding certificates.

E. Gas Pipe Installer Qualifications: Provide evidence of current qualifications for individuals performing work requiring qualifications.

F. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pressure regulators to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

D. Protect stored PE pipes and valves from direct sunlight.

1.9 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:

1. Notify Owner and Construction Manager no fewer than seven days in advance of proposed interruption of natural-gas service.
2. Do not proceed with interruption of natural-gas service without Owner's and Construction Manager's written permission.

1.10 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.

B. Natural-Gas System Pressure within Buildings: 0.5 psig or less.

2.2 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

a. Material Group: 1.1.
b. End Connections: Threaded or butt welding to match pipe.
c. Lapped Face: Not permitted underground.

d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.

B. PE Pipe: ASTM D 2513, SDR 11.

1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
3. Anodeless Service-Line Risers: Factory fabricated and leak tested.

a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering.
c. Aboveground Portion: PE transition fitting.
d. Outlet shall be threaded or flanged or suitable for welded connection.
e. Tracer wire connection.
f. Ultraviolet shield.
g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

2.3 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Operating-Pressure Rating: 0.5 psig.
4. End Fittings: Zinc-coated steel.
5. Threaded Ends: Comply with ASME B1.20.1.
6. Maximum Length: 72 inches

B. Quick-Disconnect Devices: Comply with ANSI Z21.41.

1. Copper-alloy convenience outlet and matching plug connector.
2. Nitrile seals.
3. Hand operated with automatic shutoff when disconnected.
4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.

C. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

D. Basket Strainers:

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.

3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

E. T-Pattern Strainers:

1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
2. End Connections: Grooved ends.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
4. CWP Rating: 750 psig.

F. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.4 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.5 MANUAL GAS SHUTOFF VALVES

A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.

1. CWP Rating: 125 psig.
2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. A.Y. McDonald Mfg. Co.
b. Apollo Flow Controls; Conbraco Industries, Inc.
c. BrassCraft Manufacturing Co.; a Masco company.
d. Lyall, R. W. & Company, Inc.
e. Perfection Corporation.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Bronze Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. A.Y. McDonald Mfg. Co.
b. Lee Brass Company.

2. Body: Bronze, complying with ASTM B 584.
3. Plug: Bronze.
4. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig.
7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. A.Y. McDonald Mfg. Co.
b. Mueller Co.
c. Xomox Corporation.

2. Body: Cast iron, complying with ASTM A 126, Class B.
3. Plug: Bronze or nickel-plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. Operator: Square head or lug type with tamperproof feature where indicated.

8. Pressure Class: 125 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

G. Cast-Iron, Lubricated Plug Valves: MSS SP-78.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. A.Y. McDonald Mfg. Co.
    b. Flowserve Corporation.
    c. Homestead Valve.
    d. Milliken Valve Company.
    e. Mueller Co.
    f. R & M Energy Systems; Robbins & Myers.

2. Body: Cast iron, complying with ASTM A 126, Class B.
3. Plug: Bronze or nickel-plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. Operator: Square head or lug type with tamperproof feature where indicated.
8. Pressure Class: 125 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.6 EARTHQUAKE VALVES

A. Earthquake Valves, Maximum Operating Pressure of 60 psig: Comply with ASCE 25.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
    a. Little Firefighter Corporation, models NAGV, VAGV, and AGV.
    b. Seismic Safety Products, LLC, Northridge series.

2. Earthquake valves shall be certified by the State of California.
3. Maximum Operating Pressure: 60 psig.
4. Cast-aluminum body with stainless-steel internal parts.
5. Nitrile-rubber, reset-stem o-ring seal.
6. Valve position, open or closed, indicator.
7. Composition valve seat with clapper held by spring or magnet locking mechanism.
8. Level indicator.
9. End Connections: Threaded for valves NPS 2 and smaller; flanged for valves NPS 2-1/2 and larger.

2.7 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

B. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Actaris.
    b. American Meter Company.
    c. Invensys.
    d. Itron Gas.

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 2 psig.

2.8 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. A.Y. McDonald Mfg. Co.
    b. Capitol Manufacturing Company.
    c. Central Plastics Company.
    d. HART Industrial Unions, LLC.
    e. Jomar Valve.
    f. Matco-Norca.
    g. Watts; a Watts Water Technologies company.
    h. Wilkins.
    i. Zurn Industries, LLC.

2. Description:

a. Standard: ASSE 1079.
b. Pressure Rating: 125 psig minimum at 180 deg F.
c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Matco-Norca.
d. Watts; a Watts Water Technologies company.
e. Wilkins.

2. Description:

a. Standard: ASSE 1079.
b. Factory-fabricated, bolted, companion-flange assembly.
c. Pressure Rating: 125 psig minimum at 180 deg F.
d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

2. Description:

a. Nonconducting materials for field assembly of companion flanges.
b. Pressure Rating: 150 psig.
c. Gasket: Neoprene or phenolic.
d. Bolt Sleeves: Phenolic or polyethylene.
e. Washers: Phenolic with steel backing washers.

2.9 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to NFPA 54 to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with NFPA 54 requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

A. Comply with NFPA 54 for installation and purging of natural-gas piping.

B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Section 31 20 00 "Earthwork" for excavating, trenching, and backfilling.

1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.

C. Install underground, PE, natural-gas piping according to ASTM D 2774.

D. Steel Piping with Protective Coating:

1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
3. Replace pipe having damaged PE coating with new pipe.

E. Copper Tubing with Protective Coating:

1. Apply joint cover kits over tubing to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.

F. Install fittings for changes in direction and branch connections.

3.4 INDOOR PIPING INSTALLATION

A. Comply with NFPA 54 for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Extend relief vent connections for line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
2. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.

a. Exception: Tubing passing through partitions or walls does not require striker barriers.

3. Prohibited Locations:

   a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
   b. Do not install natural-gas piping in solid walls or partitions.

Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

R. Connect branch piping from top or side of horizontal piping.

S. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

T. Do not use natural-gas piping as grounding electrode.

U. Install strainer on inlet of each line-pressure regulator.

V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 23 05 17 "Sleeves and Sleeve Seals for HVAC Piping."

W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 23 05 17 "Sleeves and Sleeve Seals for HVAC Piping."

X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 23 05 18 "Escutcheons for HVAC Piping."

3.5 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

B. Install underground valves with valve boxes.

C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

D. Install earthquake valves aboveground outside buildings according to listing.

E. Install anode for metallic valves in underground PE piping.

3.6 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.

3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

F. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.7 CONNECTIONS

A. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

B. Install piping adjacent to appliances to allow service and maintenance of appliances.

C. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.8 PAINTING

A. Comply with requirements in Section 099123 "Interior Painting," and Section 099600, “High-Performance Coatings” for painting interior and exterior natural-gas piping.

B. Paint exposed, exterior metal piping, valves, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

1. Alkyd System: MPI EXT 5.1D.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
c. Topcoat: Exterior alkyd enamel (flat).
d. Color: Gray.

C. Paint exposed, interior metal piping, valves, service regulators, and piping specialties, except components, with factory-applied paint or protective coating.

1. Latex Over Alkyd Primer System: MPI INT 5.1Q.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Topcoat: Interior latex (flat).
c. Color: Gray.

2. Alkyd System: MPI INT 5.1E.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Topcoat: Interior alkyd (flat).
c. Color: Gray.

D. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.9 LABELING AND IDENTIFYING

A. Comply with requirements in Section 23 05 53 "Identification for HVAC Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Test, inspect, and purge natural gas according to NFPA 54 and authorities having jurisdiction.

C. Natural-gas piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.11 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

3.12 OUTDOOR PIPING SCHEDULE

A. Underground natural-gas piping shall be the following:

1. PE pipe and fittings joined by heat fusion, service-line risers with tracer wire terminated in an accessible location.

B. Aboveground natural-gas piping shall be the following:

1. NPS 2 and Smaller: Steel pipe with malleable-iron fittings and threaded joints.
2. NPS 2-1/2 and Larger: Steel pipe with wrought-steel fittings and welded joints.

C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.13 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

A. Aboveground, branch piping shall be the following:

1. NPS 2 and Smaller: Steel pipe with malleable-iron fittings and threaded joints.
2. NPS 2-1/2 and Larger: Steel pipe with wrought-steel fittings and welded joints.

B. Aboveground, distribution piping shall be the following:

1. NPS 2 and Smaller: Steel pipe with malleable-iron fittings and threaded joints.
2. NPS 2-1/2 and Larger: Steel pipe with wrought-steel fittings and welded joints.

3.14 UNDERGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.

B. Underground:

1. PE valves conforming to CSA standards.
2. NPS 2 and Smaller: Bronze plug valves.
3. NPS 2-1/2 and Larger: Cast-iron, lubricated plug valves.

3.15 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2-1/2 and larger at service meter shall be one of the following:

1. Cast-iron, nonlubricated plug valve.
2. Two-piece, full-port, bronze ball valves with bronze trim.

B. Distribution piping valves for pipe sizes NPS 2 and smaller shall be the following:

1. Bronze plug valve.
2. Two-piece, full-port, bronze ball valves with bronze trim.

C. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be the following:

1. Cast-iron, lubricated plug valve.

2. Two-piece, full-port, bronze ball valves with bronze trim.

D. Valves in branch piping for single appliance shall be one of the following:

1. Bronze plug valve.
2. Two-piece, full-port, bronze ball valves with bronze trim.

END OF SECTION 231123

SECTION 23 21 13 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes pipe and fitting materials and joining methods for the following:

1. Copper tube and fittings.
2. Steel pipe and fittings.
3. Joining materials.
4. Transition fittings.
5. Dielectric fittings.
6. Bypass chemical feeder.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Pipe.
2. Fittings.
3. Joining materials.
4. Bypass chemical feeder.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
3. Environmental Product Declaration: For each product.
4. Health Product Declaration: For each product.
5. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.

C. Delegated-Design Submittal:

1. Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
2. Locations of pipe anchors and alignment guides and expansion joints and loops.
3. Locations of and details for penetrations, including sleeves and sleeve seals for exterior walls, floors, basement, and foundation walls.

4. Locations of and details for penetration and firestopping for fire- and smoke-rated wall and floor and ceiling assemblies.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Piping layout, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Other building services.
3. Structural members.
4. Refer to Section 23 00 50, “Common Work Results for HVAC Systems for additional requirements.

B. Qualification Data: For Installer.

C. Welding certificates.

D. Field quality-control reports.

E. Preconstruction Test Reports:

F. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on water quality.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:

1. Hot-Water Heating Piping: 100 psig at 200 deg F.
2. Chilled-Water Piping: 150 psig at 73 deg F.
3. Makeup-Water Piping: 150 psig at 73 deg F.
4. Condensate-Drain Piping: 180 deg F.
5. Air-Vent Piping: 200 deg F.
6. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

2.2 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L, and ASTM B 88, Type M.

B. Grooved, Mechanical-Joint, Wrought-Copper Fittings: ASME B16.22.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Anvil International.
   b. Victaulic Company.

2. Grooved-End Copper Fittings: ASTM B 75, copper tube or ASTM B 584, bronze casting.
3. Grooved-End-Tube Couplings: Rigid pattern unless otherwise indicated; gasketed fitting. Ductile-iron housing with keys matching pipe and fitting grooves, prelubricated EPDM gasket rated for minimum 230 deg F for use with housing, and steel bolts and nuts.

C. Wrought-Copper Unions: ASME B16.22.

2.3 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; welded and seamless, Grade B, and wall thickness as indicated in "Piping Applications" Article.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in "Piping Applications" Article.

C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in "Piping Applications" Article.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in "Piping Applications" Article.

E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in "Piping Applications" Article.

F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

H. Grooved Mechanical-Joint Fittings and Couplings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Central Sprinkler Company.
   b. S. P. Fittings.
   c. Smith-Cooper International.
   d. Victaulic Company.

2. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47/A 47M, Grade 32510 malleable iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 106/A 106M, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
3. Couplings: Ductile- or malleable-iron housing and EPDM gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

I. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

2.4 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless otherwise indicated.

   a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
   b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

F. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.5 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Charlotte Pipe and Foundry Company.

b. IPEX USA LLC.
c. KBI (King Bros. Industries).
d. Viega LLC.

2. One-piece fitting with one threaded brass or copper insert and one solvent-cement-joint end of material and wall thickness to match plastic pipe material.

B. Plastic-to-Metal Transition Unions:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Charlotte Pipe and Foundry Company.
b. IPEX USA LLC.
c. KBI (King Bros. Industries).
d. NIBCO INC.

2. Brass or copper end, solvent-cement-joint end of material and wall thickness to match plastic pipe material, rubber gasket, and threaded union.

2.6 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. A.Y. McDonald Mfg. Co.
b. Capitol Manufacturing Company.
c. Central Plastics Company.
d. HART Industrial Unions, LLC.
e. Jomar Valve.
f. Matco-Norca.
g. Watts; a Watts Water Technologies company.
h. Wilkins.
i. Zurn Industries, LLC.

2. Description:

a. Standard: ASSE 1079.
b. Pressure Rating: 125 psig minimum at 180 deg F.
c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Capitol Manufacturing Company.

b. Central Plastics Company.
c. Matco-Norca.
d. Watts; a Watts Water Technologies company.
e. Wilkins.
f. Zurn Industries, LLC.

2. Description:

a. Standard: ASSE 1079.
b. Factory-fabricated, bolted, companion-flange assembly.
c. Pressure Rating: 125 psig minimum at 180 deg F.
d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

2. Description:

a. Nonconducting materials for field assembly of companion flanges.
b. Pressure Rating: 150 psig.
c. Gasket: Neoprene or phenolic.
d. Bolt Sleeves: Phenolic or polyethylene.
e. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Elster Perfection Corporation.
b. Grinnell Mechanical Products.
c. Matco-Norca.
d. Precision Plumbing Products.
e. Victaulic Company.

2. Description:

a. Standard: IAPMO PS 66.
b. Electroplated steel nipple, complying with ASTM F 1545.
c. Pressure Rating: 300 psig at 225 deg F.
d. End Connections: Male threaded or grooved.
e. Lining: Inert and noncorrosive, propylene.

2.7 BYPASS CHEMICAL FEEDER

A. Description: Welded steel construction; 125-psig working pressure; 5-gal. capacity; with fill funnel and inlet, outlet, and drain valves.

1. Chemicals: Specially formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-water heating piping, aboveground, NPS 2 and smaller, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

B. Hot-water heating piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:

1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
2. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints (On roof only).

C. Chilled-water piping, aboveground, NPS 2 and smaller, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

D. Chilled-water piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:

1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
2. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.

E. Makeup-water piping installed aboveground shall be the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

F. Condensate-Drain Piping:

1. General Use: Type M, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
2. Condensing Boiler Condensate-Drain Piping: Schedule 40 CPVC plastic pipe and fittings and solvent-welded joints.

G. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.

H. Air-Vent Piping:

1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.

2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

I. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.

3.2 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

O. Install branch connections to mains using mechanically formed tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

P. Install valves according to Section 230523 “General-Duty Valves for HVAC Piping.”

Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

S. Install shutoff valve immediately upstream of each dielectric fitting.

T. Comply with requirements in Section 230516 "Expansion Fittings and Loops for HVAC Piping" for installation of expansion loops, expansion joints, anchors, and pipe alignment guides.

U. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.

V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.3 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.4 HANGERS AND SUPPORTS

A. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hanger, support, and anchor devices. Comply with the following requirements for maximum spacing of supports. Comply with the more stringent requirements of the CMC and this Specification.

B. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC" for seismic restraints.

C. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 7 feet.
2. NPS 1: Maximum span, 7 feet.
3. NPS 1-1/2: Maximum span, 9 feet.
4. NPS 2: Maximum span, 10 feet.
5. NPS 2-1/2: Maximum span, 11 feet.
6. NPS 3 and Larger: Maximum span, 12 feet.

E. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 3/8 inch.
2. NPS 1: Maximum span, 6 feet; minimum rod size, 3/8 inch.
3. NPS 1-1/4Maximum span, 7 feet; minimum rod size, 3/8 inch.
4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
7. NPS 3 and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch.

F. Plastic Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.

G. Fiberglass Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.

H. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

F. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

H. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.

3.6 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

D. Install ports for pressure gages and thermometers at coil inlet and outlet connections. Comply with requirements in Section 230519 "Meters and Gages for HVAC Piping."

3.7 CHEMICAL TREATMENT

A. Install bypass chemical feeders in each hydronic system where indicated.

1. Install in upright position with top of funnel not more than 48 inches above the floor.
2. Install feeder in minimum NPS 3/4 bypass line, from main with full-size, full-port, ball valve in the main between bypass connections.
3. Install NPS 3/4 pipe from chemical feeder drain to nearest equipment drain and include a full-size, full-port, ball valve.

B. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, drain, clean strainer screens, and refill with fresh water.

C. Add initial chemical treatment and maintain water quality in ranges noted above for the first year of operation.

3.8 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping

1. Tests shall be made in the presence of the authority having jurisdiction.
2. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
3. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
4. Isolate expansion tanks and determine that hydronic system is full of water.
5. Subject piping system to not less than the greater of the following hydrostatic test pressures:

a. 1.5 times the system's working pressure.
b. 100 psi.

6. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
7. After hydrostatic test pressure has been applied for at least four hours, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
8. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

END OF SECTION 232113

SECTION 232113.13 - UNDERGROUND HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Steel pipes and fittings.
2. Cased piping system.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Cased piping.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.

C. Shop Drawings: For underground hydronic piping. Signed and sealed by a professional engineer.

1. Calculate requirements for expansion compensation for underground piping.
2. Show expansion compensators, offsets, and loops with appropriate materials to allow piping movement in the required locations. Show anchors and guides that restrain piping movement with calculated loads, and show concrete thrust block dimensions.
3. Show pipe sizes, locations, and elevations. Show piping in trench, cased pipe with details showing clearances between piping, and show insulation thickness.

1.4 INFORMATIONAL SUBMITTALS

A. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet and at vertical scale of not less than 1 inch equals 5 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing hydronic piping.

B. Qualification Data: For qualified Installer.

C. Welding certificates.

D. Material Test Reports: For cased piping.

E. Source quality-control reports.

F. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Comply with provisions in ASME B31.9, "Building Services Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

B. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing hydronic piping systems with the following minimum working-pressure ratings:

1. Chilled-Water Piping: 100 psig at 200 deg F.

2.2 STEEL PIPES AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black with plain ends; type, grade, and wall thickness as indicated in "Piping Application" Article.

B. Cast-Iron, Threaded Fittings: ASME B16.4; Class 125.

C. Malleable-Iron, Threaded Fittings: ASME B16.3, Class 150.

D. Malleable-Iron Unions: ASME B16.39; Class 150.

E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Class 125; raised ground face, and bolt holes spot faced.

F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

H. Steel Welding Fittings: ASME B16.9 and ASTM A 234/A 234M, seamless or welded.

1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

I. Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

J. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and -bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

K. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

2.3 CASED PIPING SYSTEM

A. Description: Factory-fabricated piping with carrier pipe, insulation, and casing.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Insul-Tek Piping Systems, Inc.
b. Perma-Pipe, Inc.
c. REHAU.
d. Thermal Pipe Systems.
e. Uponor.

B. Carrier Pipe: Schedule 40, steel pipe and fittings.

C. Carrier Pipe Insulation:

1. Polyurethane Foam Pipe Insulation: Rigid, cellular, high-pressure injected between carrier pipe and jacket.

a. Comply with ASTM C 591; thermal conductivity (k-value) shall not exceed 0.14 Btu x in./h x sq. ft. x deg F at 75 deg F after 180 days of aging.

D. Casing: Filament-wound, fiberglass-reinforced polyester resin.

E. Casing accessories include the following:

1. Joint Kit: Half-shell, pourable or split insulation, casing sleeve, and shrink-wrap sleeve.
2. Expansion Blanket: Elastomeric foam, formed to fit over piping.
3. End Seals: Shrink wrap the casing material to seal watertight around casing and carrier pipe.

F. Manholes: Black steel with lifting eyes.

1. Finish: Spray-applied urethane, minimum 30 mils thick.

2. Access: 30-inch-diameter waterproof cover with gasket, ladder, and two 6-inch vents, one high and one low, extending above grade with rain caps.
3. Conduit Stub-Outs and Seals: Welded steel with drain and vent openings.
4. Sump: 12 inches in diameter,12 inches deep.
5. Floatation Anchor: Oversized bottom keyed into concrete base.

G. Source Quality Control: Factory test the carrier pipe to 150 percent of the operating pressure of system. Furnish test certificates.

PART 3 - EXECUTION

3.1 EARTHWORK

A. See Section 312000 "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATION

A. Chilled-Water Piping:

1. NPS 2-1/2 and larger shall be the following:

a. Cased piping with polyurethane carrier-pipe insulation.

1) Piping Insulation Thickness: 2 inches.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Remove standing water in the bottom of trench.

C. Do not backfill piping trench until field quality-control testing has been completed and results approved.

D. Install piping at uniform grade of 0.2 percent. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points and elsewhere as required for system drainage. Install manual air vents at high points.

E. Install components with pressure rating equal to or greater than system operating pressure.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. See Section 230517 "Sleeves and Sleeve Seals for HVAC Piping" for sleeves and mechanical sleeve seals through exterior building walls.

I. Secure anchors with concrete thrust blocks. Concrete is specified in Section 033000 "Cast-in-Place Concrete."

3.4 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

E. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

F. Cased Piping Joints: Assemble sections and finish joints with pourable or split insulation and exterior jacket sleeve, and apply shrink-wrap seals.

3.5 IDENTIFICATION

A. Install continuous plastic underground warning tapes during back filling of trenches for underground hydronic piping. Locate tapes 6 to 8 inches below finished grade, directly over piping. See Section 312000 "Earthwork" for warning-tape materials and devices and their installation.

3.6 FIELD QUALITY CONTROL

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Prepare hydronic piping for testing according to ASME B31.9 and as follows:

a. Leave joints, including welds, uninsulated and exposed for examination during test.
b. Fill system with water. Where there is risk of freezing, air or a safe, compatible liquid may be used.
c. Use vents installed at high points to release trapped air while filling system.

2. Test hydronic piping as follows:

a. Subject piping system to not less than the greater of the following hydrostatic test pressures:

1) 1.5 times the system's working pressure.
2) 100 psi.

b. After hydrostatic test pressure has been applied for four hours, examine joints for leakage. Remake leaking joints using new materials and repeat hydrostatic test until no leaks exist.

C. Prepare test and inspection reports.

END OF SECTION 232113.13

SECTION 23 21 16 - HYDRONIC PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Hydronic specialty valves.
2. Air-control devices.
3. Strainers.
4. Connectors.

B. Related Requirements:

1. Section 230516 "Expansion Fittings and Loops for HVAC Piping" for expansion fittings and loops.
2. Section 230523 "General-Duty Valves for HVAC Piping" for specification and installation requirements for globe valves common to most piping systems.
3. Section 230923 "Direct Digital Control System for HVAC" for automatic control valve and sensor specifications, installation requirements, and locations.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Hydronic Specialty Valves: Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
2. Air-control devices.
3. Strainers.
4. Connectors.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

1.6 QUALITY ASSURANCE

A. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 HYDRONIC SPECIALTY VALVES

A. Bronze, Calibrated-Orifice, Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Armstrong Pumps, Inc.
b. Bell & Gossett; a Xylem brand.
c. Flow Design, Inc.
d. Gerand Engineering Co.
e. Grinnell Mechanical Products.
f. Griswold Controls.
g. HCI; Hydronics Components Inc.
h. Nexus Valve, Inc.
i. NIBCO INC.
j. NuTech Hydronic Specialty Products.
k. Oventrop Corporation.
l. TACO Comfort Solutions, Inc.
m. Tour & Andersson; available through Victaulic Company.
n. Tunstall Corporation.
o. Victaulic Company.

2. Body: Bronze, ball or plug type with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Plug: Resin.
5. Seat: PTFE.
6. End Connections: Threaded or socket.
7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
8. Handle Style: Lever, with memory stop to retain set position.
9. CWP Rating: Minimum 125 psig (860 kPa).
10. Maximum Operating Temperature: 250 deg F (121 deg C).

B. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Armstrong Pumps, Inc.

b. Bell & Gossett; a Xylem brand.
c. Flow Design, Inc.
d. Gerand Engineering Co.
e. Grinnell Mechanical Products.
f. Griswold Controls.
g. HCI; Hydronics Components Inc.
h. Nexus Valve, Inc.
i. NIBCO INC.
j. NuTech Hydronic Specialty Products.
k. Oventrop Corporation.
l. TACO Comfort Solutions, Inc.
m. Tour & Andersson; available through Victaulic Company.
n. Tunstall Corporation.
o. Victaulic Company.

2. Body: Cast-iron or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Stem Seals: EPDM O-rings.
5. Disc: Glass and carbon-filled PTFE.
6. Seat: PTFE.
7. End Connections: Flanged or grooved.
8. Pressure Gage Connections: Integral seals for portable differential pressure meter.
9. Handle Style: Lever, with memory stop to retain set position.
10. CWP Rating: Minimum 125 psig (860 kPa).
11. Maximum Operating Temperature: 250 deg F (121 deg C).

C. Diaphragm-Operated, Pressure-Reducing Valves: ASME labeled.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. AMTROL, Inc.
b. Apollo Valves; Conbraco Industries, Inc.
c. Armstrong Pumps, Inc.
d. Bell & Gossett; a Xylem brand.
e. Spence Engineering Company, Inc.
f. Watts; a Watts Water Technologies company.

2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Low inlet-pressure check valve.
8. Inlet Strainer: <Insert materials>, removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

D. Diaphragm-Operated Safety Valves: ASME labeled.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. AMTROL, Inc.
    b. Apollo Valves; Conbraco Industries, Inc.
    c. Armstrong Pumps, Inc.
    d. Bell & Gossett; a Xylem brand.
    e. Spence Engineering Company, Inc.
    f. Watts; a Watts Water Technologies company.

2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Wetted, Internal Work Parts: Brass and rubber.
8. Inlet Strainer: <Insert materials>, removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

2.2 AIR-CONTROL DEVICES

A. Manual Air Vents:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. AMTROL, Inc.
    b. Apollo Valves; Conbraco Industries, Inc.
    c. Armstrong Pumps, Inc.
    d. Bell & Gossett; a Xylem brand.
    e. HCI; Hydronics Components Inc.
    f. Nexus Valve, Inc.
    g. NuTech Hydronic Specialty Products.
    h. TACO Comfort Solutions, Inc.

2. Body: Bronze.
3. Internal Parts: Nonferrous.
4. Operator: Screwdriver or thumbscrew.
5. Inlet Connection: NPS 1/2 (DN 15).
6. Discharge Connection: NPS 1/8.
7. CWP Rating: 150 psig (1035 kPa).
8. Maximum Operating Temperature: 225 deg F (107 deg C).

B. Automatic Air Vents:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. AMTROL, Inc.
b. Armstrong Pumps, Inc.
c. Bell & Gossett; a Xylem brand.
d. Nexus Valve, Inc.
e. NuTech Hydronic Specialty Products.
f. Spirotherm, Inc.
g. TACO Comfort Solutions, Inc.

2. Body: Bronze or cast iron.
3. Internal Parts: Nonferrous.
4. Operator: Noncorrosive metal float.
5. Inlet Connection: NPS 1/2 (DN 15).
6. Discharge Connection: NPS 1/4 (DN 8).
7. CWP Rating: 150 psig (1035 kPa).
8. Maximum Operating Temperature: 240 deg F (116 deg C).

C. Bladder-Type Expansion Tanks:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. AMTROL, Inc.
b. Armstrong Pumps, Inc.
c. Bell & Gossett; a Xylem brand.
d. Flo Fab.
e. TACO Comfort Solutions, Inc.

2. Tank: Welded steel, rated for 125-psig (860-kPa) working pressure and 375 deg F (191 deg C) maximum operating temperature. Factory test after taps are fabricated and supports installed and are labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
3. Bladder: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
4. Air-Charge Fittings: Schrader valve, stainless steel with EPDM seats.

D. Tangential-Type Air Separators:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. AMTROL, Inc.
b. Armstrong Pumps, Inc.
c. Bell & Gossett; a Xylem brand.
d. TACO Comfort Solutions, Inc.

2. Tank: Welded steel; ASME constructed and labeled for 125-psig (860-kPa) minimum working pressure and 375 deg F (191 deg C) maximum operating temperature.
3. Air Collector Tube: Perforated stainless steel, constructed to direct released air into expansion tank.
4. Tangential Inlet and Outlet Connections: Threaded for NPS 2 (DN 50) and smaller; flanged connections for NPS 2-1/2 (DN 65) and larger.
5. Blowdown Connection: Threaded.
6. Size: Match system flow capacity.

E. Air Purgers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. AMTROL, Inc.
   b. Armstrong Pumps, Inc.
   c. Bell & Gossett; a Xylem brand.
   d. TACO Comfort Solutions.

2. Body: Cast iron with internal baffles that slow the water velocity to separate the air from solution and divert it to the vent for quick removal.
3. Maximum Working Pressure: 150 psig (1035 kPa).
4. Maximum Operating Temperature: 250 deg F (121 deg C).

2.3 STRAINERS

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
3. Strainer Screen: Stainless-steel, [20] [40] [60]-mesh strainer, or perforated stainless-steel basket.
4. CWP Rating: 125 psig (860 kPa).

B. Basket Strainers:

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
3. Strainer Screen: [40] [60]-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig (860 kPa).

C. T-Pattern Strainers:

1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
2. End Connections: Grooved ends.
3. Strainer Screen: [40] [60]-mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
4. CWP Rating: 750 psig (5170 kPa).

2.4 CONNECTORS

A. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch (20-mm) misalignment.
4. CWP Rating: 150 psig (1035 kPa).

5. Maximum Operating Temperature: 250 deg F (121 deg C).

B. Spherical, Rubber, Flexible Connectors:

1. Body: Fiber-reinforced rubber body.
2. End Connections: Steel flanges drilled to align with Classes 150 and 300 steel flanges.
3. Performance: Capable of misalignment.
4. CWP Rating: 150 psig (1035 kPa).
5. Maximum Operating Temperature: 250 deg F (121 deg C).

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.

B. Install calibrated-orifice, balancing valves at each branch connection to return main.

C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.

D. Install check valves at each pump discharge and elsewhere as required to control flow direction.

E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

F. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.2 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Install manual vents at heat-transfer coils and elsewhere as required for air venting.

C. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a 2 percent upward slope toward tank.

D. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2 (DN 50) and larger.

E. Install tangential air separator in pump suction. Install blowdown piping with gate or full-port ball valve; extend full size to nearest floor drain.

F. Install expansion tanks above the air separator. Install tank fitting in tank bottom and charge tank. Use manual vent for initial fill to establish proper water level in tank.

1. Install tank fittings that are shipped loose.
2. Support tank from floor or structure above with sufficient strength to carry weight of tank, piping connections, fittings, plus tank full of water. Do not overload building components and structural members.

G. Install expansion tanks on the floor. Vent and purge air from hydronic system, and ensure that tank is properly charged with air to suit system Project requirements.

END OF SECTION 231116

SECTION 232123 - HYDRONIC PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Close-coupled, in-line centrifugal pumps.
2. Automatic condensate pump units.

1.3 DEFINITIONS

A. Buna-N: Nitrile rubber.

B. EPT: Ethylene propylene terpolymer.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of pump. Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.

B. Shop Drawings: For each pump.

1. Show pump layout and connections.
2. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.
3. Include diagrams for power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pumps to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Mechanical Seals: One mechanical seal(s) for each pump.

PART 2 - PRODUCTS

2.1 SEPARATELY COUPLED, BASE-MOUNTED, END-SUCTION CENTRIFUGAL PUMPS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following, or equal:

1. Armstrong Pumps, Inc.
2. Crane Pumps & Systems.
3. Grundfos Pumps Corporation.
4. ITT Corporation.
5. Mepco, LLC.
6. PACO Pumps; Grundfos Pumps Corporation, USA.
7. Patterson Pump Company; a Gorman-Rupp company.
8. Peerless Pump Company.
9. TACO Comfort Solutions, Inc.

B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, end-suction pump as defined in HI 1.1-1.2 and HI 1.3; designed for base mounting, with pump and motor shafts horizontal.

C. Capacities and Characteristics: See drawing's pump schedule for capacities and characteristics.

D. Pump Construction:

1. Casing: Radially split, cast iron, with replaceable bronze wear rings, threaded gage tappings at inlet and outlet, drain plug at bottom and air vent at top of volute, and flanged connections. Provide integral mount on volute to support the casing, and provide attached piping to allow removal and replacement of impeller without disconnecting piping or requiring the realignment of pump and motor shaft.
2. Impeller: Stainless steel; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For pumps not frequency-drive controlled, trim impeller to match specified performance.
3. Pump Shaft: Stainless steel.
4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket.
5. Pump Bearings: Grease-lubricated ball bearings in cast-iron housing with grease fittings.

E. Shaft Coupling: Molded-rubber insert and interlocking spider capable of absorbing vibration. Couplings shall be drop-out type to allow disassembly and removal without removing pump shaft or motor. EPDM coupling sleeve for variable-speed applications.

F. Coupling Guard: Dual rated; ANSI B15.1, Section 8; OSHA 1910.219 approved; steel; removable; attached to mounting frame.

G. Mounting Frame: Welded-steel frame and cross members, factory fabricated from ASTM A 36/A 36M channels and angles. Fabricate to mount pump casing, coupling guard, and motor.

H. Motor: Single speed, secured to mounting frame, with adjustable alignment.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with NEMA designation, temperature rating, service factor, shaft grounding, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

    a. Enclosure: Totally enclosed, fan cooled.
    b. Enclosure Materials: Cast iron.
    c. Motor Bearings: Permanently lubricated ball bearings.
    d. Unusual Service Conditions:

        1) Ambient Temperature: 100 deg F.
        2) Altitude: 20 feet above sea level.
        3) High humidity.

    e. Efficiency: Premium efficient.
    f. NEMA Design.
    g. Service Factor.

2.2 CLOSE-COUPLED, IN-LINE CENTRIFUGAL PUMPS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following, or equal:

1. Armstrong Pumps, Inc.
2. Crane Pumps & Systems.
3. Grundfos Pumps Corporation.
4. ITT Corporation.
5. Mepco, LLC.
6. PACO Pumps; Grundfos Pumps Corporation, USA.
7. Patterson Pump Company; a Gorman-Rupp company.
8. Peerless Pump Company.
9. TACO Comfort Solutions, Inc.

B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally or vertically.

C. Pump Construction:

1. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet, replaceable bronze wear rings, and threaded companion-flange or union-end connections.
2. Impeller: Stainless steel; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For constant-speed pumps, trim impeller to match specified performance.
3. Pump Shaft: Steel, with copper-alloy shaft sleeve.
4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Include water slinger on shaft between motor and seal.
5. Pump Bearings: Permanently lubricated ball bearings.
6. Provide pump with anti-corrosion coating suitable for marine environment.
7. Provide pump with integral variable speed drive.

D. Motor: Single speed and rigidly mounted to pump casing.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

    a. Enclosure: Totally enclosed, fan cooled.
    b. Enclosure Materials: Cast iron.
    c. Motor Bearings: Grease-lubricated ball bearings.
    d. Efficiency: Premium efficient.

E. Accessories:

1. Provide one mechanical seal for each model type of primary pump.
2. Sediment Separator: Furnish sediment separator for installation on the flushing line between the pump discharge flange and the seal area. The separator shall remove dissolved solids from the flushing medium before the fluid enters the seal area.

2.3 AUTOMATIC CONDENSATE PUMP UNITS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Beckett Corporation.
2. Hartell Pumps; Milton Roy.
3. Little Giant Pump Co.
4. Mepco, LLC.

B. Description: Packaged units with corrosion-resistant pump, plastic tank with cover, and automatic controls. Include factory- or field-installed check valve and a 72-inch- minimum, electrical power cord with plug.

2.4 PUMP SPECIALTY FITTINGS

A. Suction Diffuser:

1. Angle pattern.
2. 175-psig pressure rating, cast-iron body and end cap, pump-inlet fitting.
3. Bronze startup and bronze or stainless-steel permanent strainers.
4. Bronze or stainless-steel straightening vanes.
5. Drain plug.
6. Factory-fabricated support.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.

C. Examine foundations and inertia bases for suitable conditions where pumps are to be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings, and accessories.

C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

D. Automatic Condensate Pump Units: Install units for collecting condensate and extend to open drain.

E. Equipment Mounting:

1. Refer to details on Drawings.
2. Install base-mounted pumps on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
3. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

3.3 ALIGNMENT

A. Engage a factory-authorized service representative to perform alignment service.

B. Comply with requirements in Hydronics Institute standards for alignment of pump and motor shaft. Add shims to the motor feet and bolt motor to base frame. Do not use grout between motor feet and base frame.

C. Comply with pump and coupling manufacturers' written instructions.

D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with nonshrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

3.4 CONNECTIONS

A. Where installing piping adjacent to pump, allow space for service and maintenance.

B. Connect piping to pumps. Install valves that are same size as piping connected to pumps.

C. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

D. Install check, shutoff, and throttling valves on discharge side of pumps.

E. Install suction diffuser and shutoff valve on suction side of pumps.

F. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.

G. Install pressure gages on pump suction and discharge or at integral pressure-gage tapping, or install single gage with multiple-input selector valve.

H. Install check valve and gate or ball valve on each condensate pump unit discharge.

I. Ground equipment according to Section 260501 "Basic Electrical Materials and Methods."

J. Connect wiring according to Section 260530 "Conduit and Wire."

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Perform the following startup checks for each pump before starting:

    a. Verify bearing lubrication.
    b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
    c. Verify that pump is rotating in the correct direction.

5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
6. Start motor.
7. Open discharge valve slowly.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps. Provide minimum 2 hours training.

END OF SECTION 232123

SECTION 23 23 00 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Refrigerant pipes and fittings.
2. Refrigerant piping valves and specialties.

1.2 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Heat-Pump Applications: 535 psig.
2. Hot-Gas and Liquid Lines: 535 psig.

1.3 ACTION SUBMITTALS

A. Shop Drawings:

1. Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.
2. Show piping size and piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
3. Show interface and spatial relationships between piping and equipment.
4. Shop Drawing Scale: 1/4 inch equals 1 foot.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control test reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.7 PRODUCT STORAGE AND HANDLING

A. Store piping with end caps in place to ensure that piping interior and exterior are clean when installed.

1.8 COORDINATION

A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 280, Type ACR. Refer to piping application schedules in PART 3 of this Section.

1. Manufactured, pre-charged and pre-insulated refrigerant line-set refrigerant piping may be utilized at Contractor’s discretion.
2. VRF Systems: Use of manufactured, pre-charged and pre-insulated refrigerant line-set refrigerant piping between outdoor condensing units and indoor distribution headers and tees is not allowed. When system manufacturer’s installation instructions allow use of refrigerant line-set piping between distribution headers and tees, and air terminal devices, follow instructions for allowable pipe size range and support to avoid forming traps in the piping.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Brazing Filler Metals: AWS A5.8.

E. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch- long assembly.
4. Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

2.2 REFRIGERANTS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Atofina Chemicals, Inc.
2. DuPont Company; Fluorochemicals Div.
3. Honeywell, Inc.; Genetron Refrigerants.
4. INEOS Fluor Americas LLC.

C. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction, Hot Gas and Liquid Lines, all Sizes, for Heat Pump Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed joints.

B. Safety-Relief-Valve Discharge Piping:

1. Safety relief valve piping shall be as specified for refrigerant piping.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Refer to Section 230923 "Direct Digital Control System for HVAC" for solenoid valve controllers and control wiring.

K. Refer Drawings for sequence of operation.

L. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

M. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

N. Install refrigerant piping in protective conduit where installed belowground.

O. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

P. Install manufactured, pre-charged and pre-insulated refrigerant line-set refrigerant piping in rigid or flexible conduit.

Q. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

R. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

S. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

T. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."

U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.3 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

3.4 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 3/8 inch.
2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 3/8 inch.
3. NPS 1: Maximum span, 72 inches; minimum rod size, 3/8 inch.
4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
7. NPS 2-1/2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
8. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
9. NPS 4: Maximum span, 12 feet; minimum rod size, 1/2 inch.

D. Support multifloor vertical runs at least at each floor.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.

a. Fill system with nitrogen to the required test pressure.
b. System shall maintain test pressure at the manifold gage throughout duration of test.

c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.6 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

END OF SECTION 232300

SECTION 232923 - VARIABLE-FREQUENCY MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This specification covers complete a variable frequency drives (VFDs) designated on the drawing schedules to be variable speed. All standard and optional features shall be included within the VFD panel. The VFD shall be UL Type 1 for clean environments, or UL Type 12 for dusty environments. The VFD shall have been evaluated by UL and found acceptable for mounting in a plenum or other air handling compartment. Manufacturer shall supply a copy of the UL plenum evaluation upon request.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and rating of VFD indicated.

1. Include dimensions and finishes for VFDs.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For each VFD indicated.

1. Include mounting and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Required working clearances and required area above and around VFDs.
2. Show VFD layout and relationships between electrical components and adjacent structural and mechanical elements.
3. Show support locations, type of support, and weight on each support.
4. Indicate field measurements.
5. Refer to Section 23 00 50, “Common Work Results for HVAC Systems for additional requirements.

B. Source quality-control reports.

C. Field quality-control reports.

D. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For VFDs to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

    a. Manufacturer's written instructions for testing and adjusting thermal-magnetic circuit breaker and motor-circuit protector trip settings.
    b. Manufacturer's written instructions for setting field-adjustable overload relays.
    c. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.
    d. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.
    e. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate, full-load currents.
    f. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor-running overload protection suit actual motors to be protected.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
3. Indicating Lights: Two of each type and color installed.
4. Auxiliary Contacts: Furnish one spare(s) for each size and type of magnetic controller installed.
5. Power Contacts: Furnish three spares for each size and type of magnetic contactor installed.

1.7 QUALITY ASSURANCE

A. The VFD shall be tested to UL 508C. The appropriate UL label shall be applied.

B. The VFD shall be UL listed for a short circuit current rating of 100 kA and labeled with this rating.

C. To ensure adequate technical and factory support, VFDs manufactured by others and brand labeled shall not be acceptable.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace VFDs that fail in materials or workmanship within specified warranty period.

1. The complete VFD shall be warranted by the manufacturer for a period of 36 months from date of shipment. The warranty shall include parts, labor, travel costs and living expenses incurred by the manufacturer to provide factory authorized on-site service. The warranty shall be provided by the VFD manufacturer and not a third party. A written warranty statement shall be provided with the submittals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Danfoss, Inc., VLC HVAC Drive FC 102, or equal by the following:

1. ABB.
2. Yaskawa Electric America, Inc.

2.2 GENERAL REQUIREMENTS FOR VFDs:

A. VFDs and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 DESCRIPTION

A. The VFD shall convert incoming fixed frequency three-phase AC power into an adjustable frequency and voltage for controlling the speed of three-phase AC motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for the driven load and to eliminate the need for motor derating.

B. The VFD shall allow the motor to produce full rated power at rated motor voltage, current, and speed without using the motor's service factor. VFDs utilizing sine weighted/coded modulation (with or without 3rd harmonic injection) must provide data verifying that the motors will not draw more than full load current during full load and full speed operation.

C. The VFD shall include an input full-wave bridge rectifier and maintain a fundamental (displacement) power factor near unity regardless of speed or load.

D. The VFD shall have a dual 5 percent impedance DC link reactor on the positive and negative rails of the DC bus to minimize power line harmonics and protect the VFD from power line transients. The chokes shall be non-saturating. Swinging chokes that do not provide full harmonic filtering throughout the entire load range are not acceptable. VFDs with saturating (non-linear) DC link reactors shall require an additional 3 percent AC line reactor to provide acceptable harmonic performance at full load, where harmonic performance is most critical.

E. The VFD's full load output current rating shall meet or exceed NEC Table 430-150. The VFD shall be able to provide full rated output current continuously, 110 percent of rated current for 60 seconds and 120 percent of rated torque for up to 0.5 second while starting.

F. The VFD shall provide full motor torque at any selected frequency from 20 Hz to base speed while providing a variable torque V/Hz output at reduced speed. This is to allow driving direct drive fans without high speed derating or low speed excessive magnetization, as would occur if a constant torque V/Hz curve was used at reduced speeds. Breakaway current of 160 percent shall be available.

G. A programmable automatic energy optimization selection feature shall be provided standard in the VFD. This feature shall automatically and continuously monitor the motor's speed and load to adjust the applied voltage to maximize energy savings.

H. The VFD must be able to produce full torque at low speed to operate direct drive fans.

I. Output power circuit switching shall be able to be accomplished without interlocks or damage to the VFD.

J. An automatic motor adaptation algorithm shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to run the motor or de-couple the motor from the load to perform the test.

K. Galvanic isolation shall be provided between the VFD's power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. VFDs not including either galvanic or optical isolation on both analog I/O and discrete digital I/O shall include additional isolation modules.

L. VFD shall minimize the audible motor noise through the used of an adjustable carrier frequency. The carrier frequency shall be automatically adjusted to optimize motor and VFD operation while reducing motor noise. VFDs with fixed carrier frequency are not acceptable.

M. All VFDs shall contain integral EMI filters to attenuate radio frequency interference conducted to the AC power line.

2.4 PROTECTIVE FEATURES

A. A minimum of Class 20 I^2t electronic motor overload protection for single motor applications shall be provided. Overload protection shall automatically compensate for changes in motor speed.

B. Protection against input transients, loss of AC line phase, output short circuit, output ground fault, over voltage, under voltage, VFD over temperature and motor over temperature. The VFD shall display all faults in plain language. Codes are not acceptable.

C. Protect VFD from input phase loss. The VFD should be able to protect itself from damage and indicate the phase loss condition. During an input phase loss condition, the VFD shall be able to be programmed to either trip off while displaying an alarm, issue a warning while running at reduced output capacity, or issue a warning while running at full commanded speed. This function is independent of which input power phase is lost.

D. Protect from under voltage. The VFD shall provide full rated output with an input voltage as low as 90 percent of the nominal. The VFD will continue to operate with reduced output, without faulting, with an input voltage as low as 70 percent of the nominal voltage.

E. Protect from over voltage. The VFD shall continue to operate without faulting with a momentary input voltage as high as 130 percent of the nominal voltage.

F. The VFD shall incorporate a programmable motor preheat feature to keep the motor warm and prevent condensation build up in the motor when it is stopped in a damp environment by providing the motor stator with a controlled level of current.

G. VFD shall include a "signal loss detection" algorithm with adjustable time delay to sense the loss of an analog input signal. It shall also include a programmable time delay to eliminate nuisance signal loss indications. The functions after detection shall be programmable.

H. VFD shall function normally when the keypad is removed while the VFD is running. No warnings or alarms shall be issued as a result of removing the keypad.

I. VFD shall catch a rotating motor operating forward or reverse up to full speed without VFD fault or component damage.

J. Selectable over-voltage control shall be provided to protect the drive from power regenerated by the motor while maintaining control of the driven load.

K. VFD shall include current sensors on all three output phases to accurately measure motor current, protect the VFD from output short circuits, output ground faults, and act as a motor overload. If an output phase loss is detected, the VFD will trip off and identify which of the output phases is low or lost.

L. If the temperature of the VFD's heat sink rises to 80°C, the VFD shall automatically reduce its carrier frequency to reduce the heat sink temperature. It shall also be possible to program the VFD so that it reduces its output current limit value if the VFD's temperature becomes too high.

M. In order to ensure operation during periods of overload, it must be possible to program the VFD to automatically reduce its output current to a programmed value during periods of excessive load. This allows the VFD to continue to run the load without tripping.

N. The VFD shall have temperature controlled cooling fan(s) for quiet operation, minimized losses, and increased fan life. At low loads or low ambient temperatures, the fan(s) may be off even when the VFD is running.

O. The VFD shall store in memory the last 10 alarms. A description of the alarm, and the date and time of the alarm shall be recorded.

P. When used with a pumping system, the VFD shall be able to detect no-flow situations, dry pump conditions, and operation off the end of the pump curve. It shall be programmable to take appropriate protective action when one of the above situations is detected.

2.5 INTERFACE FEATURES

A. Hand, Off and Auto keys shall be provided to start and stop the VFD and determine the source of the speed reference. It shall be possible to either disable these keys or password protect them from undesired operation.

B. There shall be an "Info" key on the keypad. The Info key shall include "on-line" context sensitive assistance for programming and troubleshooting.

C. The VFD shall be programmable to provide a digital output signal to indicate whether the VFD is in Hand or Auto mode. This is to alert the Building Automation System whether the VFD is being controlled locally or by the Building Automation System.

D. Password protected keypad with alphanumeric, graphical, backlit display can be remotely mounted. Two levels of password protection shall be provided to guard against unauthorized parameter changes.

E. All VFDs shall have the same customer interface. The keypad and display shall be identical and interchangeable for all sizes of VFDs.

F. To set up multiple VFDs, it shall be possible to upload all setup parameters to the VFD's keypad, place that keypad on all other VFDs in turn and download the setup parameters to each VFD. To facilitate setting up VFDs of various sizes, it shall be possible to download from the keypad only size independent parameters. Keypad shall provide visual indication of copy status.

G. Display shall be programmable to communicate in multiple languages including English, Spanish and French.

H. A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed.

I. A quick setup menu with factory preset typical HVAC parameters shall be provided on the VFD. The VFD shall also have individual Fan, Pump, and Compressor menus specifically designed to facilitate start-up of these applications.

J. A three-feedback PID controller to control the speed of the VFD shall be standard.

1. This controller shall accept up to three feedback signals. It shall be programmable to compare the feedback signals to a common setpoint or to individual setpoints and to automatically select either the maximum or the feedback signal as the controlling signal. It shall also be possible to calculate the controlling feedback signal as the average of all feedback signals or the difference between a pair of feedback signals.
2. The VFD shall be able to apply individual scaling to each feedback signal.
3. For fan flow tracking applications, the VFD shall be able to calculate the square root of any or all individual feedback signals so that a pressure sensor can be used to measure air flow.
4. The VFD's PID controller shall be able to actively adjust its setpoint based on flow. This allows the VFD to compensate for a pressure feedback sensor which is located near the output of the pump rather than out in the controlled system.

K. The VFD shall have three additional PID controllers which can be used to control damper and valve positioners in the system and to provide setpoint reset.

L. Floating point control interface shall be provided to increase/decrease speed in response to contact closures.

M. Five simultaneous meter displays shall be available. They shall include at a minimum, frequency, motor current, motor voltage, VFD output power, VFD output energy, VFD temperature in degrees, among others.

N. Programmable Sleep Mode shall be able to stop the VFD. When its output frequency drops below set "sleep" level for a specified time, when an external contact commands that the VFD go into Sleep Mode, or when the VFD detects a no-flow situation, the VFD may be programmed to stop. When the VFD's speed is being controlled by its PID controller, it shall be possible to program a "wake-up" feedback value that will cause the VFD to start. To avoid excessive starting and stopping of the driven equipment, it shall be possible to program a minimum run time before sleep mode can be initiated and a minimum sleep time for the VFD.

O. A run permissive circuit shall be provided to accept a "system ready" signal to ensure that the VFD does not start until dampers or other auxiliary equipment are in the proper state for VFD operation. The run permissive circuit shall also be capable of initiating an output "run request" signal to indicate to the external equipment that the VFD has received a request to run.

P. VFD shall be programmable to display feedback signals in appropriate units, such as inches of water column (in-wg), pressure per square inch (psi) or temperature (°F).

Q. VFD shall be programmable to sense the loss of load. The VFD shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. To ensure against nuisance indications, this feature must be based on motor torque, not current, and must include a proof timer to keep brief periods of no load from falsely triggering this indication.

R. Standard Control and Monitoring Inputs and Outputs

1. Four dedicated, programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.
2. Two terminals shall be programmable to act as either as digital outputs or additional digital inputs.
3. Two programmable relay outputs, Form C 240 V AC, 2 A, shall be provided for remote indication of VFD status.

    a. Each relay shall have an adjustable on delay / off delay time.

4. Two programmable analog inputs shall be provided that can be either direct-or-reverse acting.

    a. Each shall be independently selectable to be used with either an analog voltage or current signal.
    b. The maximum and minimum range of each shall be able to be independently scalable from 0 to 10 V dc and 0 to 20 mA.
    c. A programmable low-pass filter for either or both of the analog inputs must be included to compensate for noise.
    d. The VFD shall provide front panel meter displays programmable to show the value of each analog input signal for system set-up and troubleshooting,

5. One programmable analog current output (0/4 to 20 mA) shall be provided for indication of VFD status. This output shall be programmable to show the reference or feedback signal supplied to the VFD and for VFD output frequency, current and power. It shall be possible to scale the minimum and maximum values of this output.
6. It shall be possible through serial bus communications to read the status of all analog and digital inputs of the VFD.
7. It shall be possible to command all digital and analog output through the serial communication bus.

S. Optional Control and Monitoring Inputs and Outputs

1. It shall be possible to add optional modules to the VFD in the field to expand its analog and digital inputs and outputs.
2. These modules shall use rigid connectors to plug into the VFD's control card.
3. The VFD shall automatically recognize the option module after it is powered up. There shall be no need to manually configure the module.
4. Modules may include such items as:

    a. Additional digital outputs, including relay outputs
    b. Additional digital inputs

c. Additional analog outputs
d. Additional analog inputs, including Ni or Pt temperature sensor inputs

5. It shall be possible through serial bus communications to control the status of all optional analog and digital outputs of the VFD.

T. Standard programmable firefighter's override mode allows a digital input to control the VFD and override all other local or remote commands. It shall be possible to program the VFD so that it will ignore most normal VFD safety circuits including motor overload. The VFD shall display FIREMODE whenever in firefighter's override mode. Firemode shall allow selection of forward or reverse operation and the selection of a speed source or preset speed, as required to accommodate local fire codes, standards and conditions.

U. A real-time clock shall be an integral part of the VFD.

1. It shall be possible to use this to display the current date and time on the VFD's display.
2. Ten programmable time periods, with individually selectable ON and OFF functions shall be available. The clock shall also be programmable to control start/stop functions, constant speeds, PID parameter setpoints and output relays. Is shall be possible to program unique events that occur only during normal work days, others that occur only on non-work days, and others that occur on specific days or dates. The manufacturer shall provide free PC-based software to set up the calendar for this schedule.
3. All VFD faults shall be time stamped to aid troubleshooting.
4. It shall be possible to program maintenance reminders based on date and time, VFD running hours, or VFD operating hours.
5. The real-time clock shall be able to time and date stamp all faults recorded in the VFD fault log.

V. The VFD shall be able to store load profile data to assist in analyzing the system demand and energy consumption over time.

W. The VFD shall include a sequential logic controller to provide advanced control interface capabilities. This shall include:

1. Comparators for comparing VFD analog values to programmed trigger values
2. Logic operators to combine up to three logic expressions using Boolean algebra
3. Delay timers
4. A 20-step programmable structure

X. The VFD shall include a Cascade Controller which allows the VFD to operate in closed loop set point (PID) control mode one motor at a controlled speed and control the operation of 3 additional constant speed motor starters.

2.6 ELECTRO-MECHANICALLY CONTROLLED BYPASS (EMB)

A. Where scheduled on Drawings, provide VFD unit with bypass function.

B. Bypass Power Features:

1. Three-Contactor bypass shall be provided that allows operation of the motor via line power in the event of a failure of the VFD. Motor control selection shall be through either a VFD output contactor or a bypass contactor that is interlocked to ensure that both contactors are not energized simultaneously.
2. Main input disconnect shall be provided that removes power from both the bypass and VFD.
3. VFD-only, fast acting input fuses shall be provided.

4. Overload protection shall be supplied in bypass mode.

    a. Adjustable current setting for complete motor protection when operating on line power.
    b. Overload protection shall include phase loss and phase imbalance protection.
    c. Visual indication of an overload trip condition shall be displayed on the VFD keypad.
    d. Resetting an overload trip condition shall not require the opening of the enclosure door for safety reasons and shall be accomplished via a digital input, door mounted device (drive keypad), or over the serial communications.

5. A third contactor, the drive input contactor, shall be supplied. This allows powering of the VFD with the motor off or operating in bypass mode for testing, programming and troubleshooting purposes.
6. Main input motor rated fuses that protect the entire package shall be provided.
7. All panels shall be marked for 100,000 amp short circuit current rating.

C. Bypass Interface and Control Features:

1. Bypass or VFD selection shall be via a DRIVE – OFF –BYPASS – TEST selector switch.
2. A BYPASS pilot light will illuminate when operating in bypass mode.
3. The TEST position shall allow the ability to supply power to the drive for testing purposes while running the motor in bypass.
4. Selection of Bypass or VFD operation shall be by any one of the following: Manually via the VFD keypad, remotely via a contact closure from the BMS system, commanded over the communication network or automatic bypass operation based on VFD programming.
5. Bypass package shall include an External Safety interlock that will disable motor operation in either bypass or VFD mode when open.
6. EMB control package shall be provided. This package includes the following features:

    a. There shall be complete Common Start/Stop command when operating in either Bypass or VFD mode. While operating in Bypass mode, the keypad shall allow the selection of Hand or Remote motor starting. In Hand and Bypass modes, pushing the keypad start button shall initiate motor operation via line power. When in Remote and Bypass modes are selected, the motor shall start just as it would have in VFD and Remote mode. This start source can be via either a hardwired start command, the VFD's real time clock or a command over BAS communication. Bypass packages that only allow common remote start/stop command when this command is hardwired to the package are not acceptable.
    b. Selectable Run Permissive logic shall operate in either VFD or bypass operation. When activated, any command to start the motor, in either Hand Bypass, Remote Bypass, Hand VFD or Remote VFD shall not start the motor, but instead close a relay contact that is used to initiate operation of another device, such as an outside air damper. A contact closure from this device shall confirm that it is appropriately actuated and the motor shall then start.
    c. Firemode operation input shall be available. When closed, the motor shall run in bypass mode regardless of operating mode selected and will ignore calls to stop. These include the opening of the external safety interlock circuit or the tripping of the motor overload.

D. Additional Protective Features:

1. In additional to the power and operational protective features listed above, each bypass shall include the following:

    a. Low voltage contactor operation shall be maintained to 70% of the package's nominally rated voltage. This will ensure VFD operation on low voltage conditions that would otherwise be interrupted due to contactor dropout.

2. Low voltage contactor operation shall be maintained to 70% of the package's nominally rated voltage. This will ensure VFD operation on low voltage conditions that would otherwise be interrupted due to contactor dropout.

2.7 SERIAL COMMUNICATIONS

A. The VFD shall include a standard EIA-485 communications port and capabilities to be connected to the following serial communication protocols at no additional cost and without a need to install any additional hardware or software in the VFD:

1. Johnson Controls Metasys N2
2. Modbus RTU
3. Siemens FLN

B. Optional communication shall include:

1. LonWorks Free Topology (FTP)
2. BACnet MS/TP

C. VFD shall have standard USB port for direct connection of Personal Computer (PC) to the VFD. The manufacturer shall provide no-charge PC software to allow complete setup and access of the VFD and logs of VFD operation through the USB port. It shall be possible to communicate to the VFD through this USB port without interrupting VFD communications to the building management system.

D. The VFD shall have provisions for an optional 24 V DC back-up power interface to power the VFD's control card. This is to allow the VFD to continue to communicate to the building automation system even if power to the VFD is lost.

2.8 ADJUSTMENTS

A. The VFD shall have a manually adjustable carrier frequency that can be adjusted in 0.5 kHz increments to allow the user to select the desired operating characteristics. The VFD shall also be programmable to automatically reduce its carrier frequency to avoid tripping due to thermal loading.

B. Four independent setups shall be provided.

C. Four preset speeds per setup shall be provided for a total of 16.

D. Each setup shall have two programmable ramp up and ramp down times. Acceleration and deceleration ramp times shall be adjustable over the range from 1 to 3,600 seconds.

E. Each setup shall be programmable for a unique current limit value. If the output current from the VFD reaches this value, any further attempt to increase the current produced by the VFD will cause the VFD to reduce its output frequency to reduce the load on the VFD. If desired, it shall be possible to program a timer which will cause the VFD to trip off after a programmed time period.

F. If the VFD trips on one of the following conditions, the VFD shall be programmable for automatic or manual reset: external interlock, under-voltage, over-voltage, current limit, over temperature, and VFD overload.

G. The number of restart attempts shall be selectable from 0 through 20 or infinitely and the time between attempts shall be adjustable from 0 through 600 seconds.

H. An automatic “start delay” may be selected from 0 to 120 seconds. During this delay time, the VFD shall be programmable to either apply no voltage to the motor or apply a DC braking current if desired.

I. Four programmable critical frequency lockout ranges to prevent the VFD from operating the load at a speed that causes vibration in the driven equipment shall be provided. Semi-automatic setting of lockout ranges shall simplify the set-up.

2.9 OPTIONAL FEATURES

A. All optional features shall be built and mounted by VFD manufacturer. All optional features shall be UL listed by the VFD manufacturer as a complete assembly and carry a UL label.

B. All panels shall be marked for their short circuit current rating in compliance with UL.

2.10 SERVICE CONDITIONS

A. Ambient temperature, continuous, full speed, full load operation:

1. -10 to 45°C (14 to 113°F) through 125 HP @ 460 and 600 volt, through 60 HP @ 208 volt
2. -10 to 40°C (14 to 104°F) 150 HP and larger

B. 0 to 95 percent relative humidity, non-condensing.

C. Elevation to 3,300 feet without derating.

D. AC line voltage variation, -10 to +10 percent of nominal with full output.

E. No side clearance shall be required for cooling.

F. All power and control wiring shall be done from the bottom.

G. All VFDs shall be plenum rated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, surfaces, and substrates to receive VFDs, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of the Work.

B. Examine VFD before installation. Reject VFDs that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for conduit systems to verify actual locations of conduit connections before VFD installation.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Wall-Mounting Controllers: Install with tops at uniform height and with disconnect operating handles not higher than 79 inches above finished floor, unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks complying with Section 260501 "Basic Electrical Materials and Methods."

B. Floor-Mounting Controllers: Install VFDs on 4-inch nominal thickness concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Seismic Bracing: Comply with requirements specified in Section 260500 "Common Work Results for Electrical."

D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

E. Install fuses in each fusible-switch VFD.

F. Install fuses in control circuits if not factory installed. Comply with requirements in Section 260501 "Basic Electrical Materials and Methods."

G. Install heaters in thermal-overload relays. Select heaters based on actual nameplate full-load amperes after motors are installed.

H. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

I. Comply with NECA 1.

3.3 CONTROL WIRING INSTALLATION

A. Install wiring between VFDs and remote devices and facility's central-control system. Comply with requirements in Section 260530 "Conduit and Wire."

B. Bundle, train, and support wiring in enclosures.

C. Connect selector switches and other automatic-control devices where applicable.

1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switches are in manual-control position.
2. Connect selector switches with control circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor-overload protectors.

3.4 IDENTIFICATION

A. Identify VFDs, components, and control wiring. Comply with requirements for identification specified in Section 260500 "Common Work Results for Electrical."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each VFD with engraved nameplate.
3. Label each enclosure-mounted control and pilot device.

B. Operating Instructions: Frame printed operating instructions for VFDs, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of VFD units.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Acceptance Testing Preparation:

1. Test insulation resistance for each VFD element, bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

D. Tests and Inspections:

1. Inspect VFD, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
2. Test insulation resistance for each VFD element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Verify that voltages at VFD locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Architect before starting the motor(s).
5. Test each motor for proper phase rotation.
6. Perform tests according to the Inspection and Test Procedures for Adjustable Speed Drives stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
8. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

E. VFDs will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports, including a certified report that identifies the VFD and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.7 ADJUSTING

A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.

B. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

C. Adjust the trip settings of instantaneous-only circuit breakers and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to 6 times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed 8 times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Architect before increasing settings.

D. Set the taps on reduced-voltage autotransformer controllers.

E. Set field-adjustable circuit-breaker trip ranges

F. Set field-adjustable pressure switches.

3.8 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until controllers are ready to be energized and placed into service.

B. Replace VFDs whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, reprogram, and maintain VFDs.

B. Harmonic filtering. The VFD supplier shall, with the aid of the buyer’s detailed electrical power single line diagram showing all impedances in the power path to the VFDs, perform an analysis to initially demonstrate the supplied equipment will met the IEEE recommendations after installation. If, as a result of the analysis, it is determined that additional filter equipment is required to meet the IEEE recommendations, then the cost of such equipment shall be included in the drive supplier quotation.

END OF SECTION 232923

6/06

This page intentionally left blank.

SECTION 23 31 13 - METAL DUCTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.1 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.
7. Seismic-restraint devices.

B. Related Sections:

1. Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 23 33 00 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," and ASCE/SEI 7, as referenced by the CBC.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

3. Seismic-restraint devices.

B. Sustainable Design Submittals:

1. Product Data: Documentation indicating that duct systems comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
2. Product Data: For adhesives, indicating VOC content.
3. Product Data: For sealants, indicating VOC content.

C. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

D. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports and seismic restraints.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:

a. Lighting Fixtures.
b. Air outlets and inlets.

c. Speakers.
d. Sprinklers.
e. Access panels.
f. Perimeter moldings.

7. Refer to Section 23 00 50, "Common Work Results for HVAC Systems for additional requirements.

B. Welding certificates.

C. Field quality-control reports.

1.5 COORDINATED LAYOUT:

A. Coordinated layouts are required to amplify, expand and coordinate the information contained in the Contract Documents.

B. Provide minimum 1/4 inch equals one foot scaled coordinated layout drawings showing plan and pertinent section or elevation views of piping, ductwork, equipment, accessories, and electrical systems. Drawings shall be reproducible and work of each trade represented shall be fully coordinated with structure, other disciplines, and finished surfaces. Drawings shall be presented on a single size sheet. Coordinated layout drawings shall have title block, key plan, north arrow and sufficient grid lines to provide cross-reference to design Drawings.
1. Provide a stamp or title block on each drawing with locations for signatures from all contractors involved, including but not limited to the General, HVAC, Plumbing, Fire Protection, and Electrical contractors. Include statement for signature that the contractor has reviewed the coordinated layout drawings in detail and has coordinated the work of his trade.
2. Show on drawings the intended elevation of all ductwork in accordance with the following example:

B.O.D. = 9'-0"
OFFSET UP 6"
B.O.D. = 9'-6"

3. Highlight, encircle or otherwise indicate deviations from the Contract Documents on the coordinated layouts. Architect will not be responsible for identifying deviations from the original Contract Documents.

C. Since scale of contract drawings is small and all offsets and fittings are not shown, Contractor shall make allowances in bid for additional coordination time, detailing, fittings, offsets, hangers and the like to achieve a fully coordinated installation. If changes in duct size are required, equivalent area shall be maintained and the aspect ratio shall not be in excess of 2 to 1 unless approved by the engineer. Drawings shall be submitted for review prior to fabrication and installation. Drawings may be submitted in packages representing at least one quarter of the building ductwork.

D. Check routing on all ductwork before fabricating. Report any discrepancies to Architect. No extra cost will be allowed for failure to conform to above.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants, and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).

2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." Square elbows with and without turning vanes will not be allowed. In their place 1-1/2 radius, 1 radius and SMACNA RE-3 elbow will be used in place of square elbows.

2.3 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Ductmate Industries, Inc.
b. Elgen Manufacturing.
c. Linx Industries (formerly Lindab).
d. McGill AirFlow LLC.
e. MKT Metal Manufacturing.
f. SEMCO Incorporated.
g. Sheet Metal Connectors, Inc.
h. Spiral Manufacturing Co., Inc.
i. Stamped Fittings Inc.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.4 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.5 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. CertainTeed Corporation.
b. Johns Manville; a Berkshire Hathaway company.
c. Knauf Insulation.
d. Owens Corning.

1) Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
2) Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2. Provide internal duct lining where indicated on the Drawings, with a minimum of 10'-0" length in each direction from the fan, fan casing, or unit casing. Provide additional lining length where shown. Line all transfer ducts.

a. Where ductwork is exposed to weather or outside the building insulation envelope, provide 2 inch thick, 1-1/2 pound density internal lining with matte facing, with an R-Value of 8.0 minimum.
b. Where ductwork is within the building insulation envelope, lining shall be 1” thick, 1-1/2 pound density, with R-value of 4.2 minimum.

3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
4. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

a. Adhesive: As recommended by duct liner manufacturer and with a VOC content of 80 g/L or less.
b. Adhesive shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

B. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick stainless steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.

5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

    a. Fan discharges.
    b. Intervals of lined duct preceding unlined duct.
    c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

2.6 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. Sealant shall have a VOC content of 420 g/L or less.
7. Sealant shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

E. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.

3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.7 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

D. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

F. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

2.8 SEISMIC-RESTRAINT DEVICES

A. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of the Office of Statewide Health Planning and Development for the State of California.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

B. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.

C. Restraint Cables: ASTM A 603, galvanized cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.

D. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or Reinforcing steel angle clamped to hanger rod.

E. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.4 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with CBC and ASCE/SEI 7, as referenced by the CBC.

1. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
2. Brace a change of direction longer than 12 feet.

B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on ducts that are suspended with vibration isolators.

E. Install seismic-restraint devices using methods approved by an evaluation service member of the Office of Statewide Health Planning and Development for the State of California.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

G. Drilling for and Setting Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099123 "Interior Painting."

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Ductwork Sealing and Leak Testing:

1. All ductwork shall receive a Class A seal.
2. Seal airtight all joints and seams, including standing seams and manufactured joints and seams, of all supply, return and exhaust ducts except those exposed in conditioned space.
3. All duct systems (supply, return, outside air intake, and exhaust), except those identified on compliance forms on Drawings as requiring Acceptance Testing per the requirements of the California Energy Code, shall be tested in accordance with the requirements of SMACNA’s “HVAC Air Duct Leakage Test Manual.” Test pressure shall be equal to the pressure class of the duct. For additional duct leak testing requirements, refer to Section 230050, “Common Work Results for HVAC Systems,” Article, “Acceptance Requirements.”

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
    a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.8 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.

4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.9 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.10 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated:

B. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

    a. Pressure Class: Positive 2-inch wg.
    b. SMACNA Leakage Class for Rectangular: 16.
    c. SMACNA Leakage Class for Round and Flat Oval: 8.

2. Ducts Connected to Constant-Volume Air-Handling Units:

    a. Pressure Class: Positive 2-inch wg.
    b. SMACNA Leakage Class for Rectangular: 16.
    c. SMACNA Leakage Class for Round and Flat Oval: 8.

3. Ducts Connected to Variable-Air-Volume Air-Handling Units:

    a. Pressure Class: Positive 4-inch wg.
    b. SMACNA Leakage Class for Rectangular: 4.
    c. SMACNA Leakage Class for Round and Flat Oval: 2.

4. Ducts Connected to Equipment Not Listed Above:

    a. Pressure Class: Positive 2-inch.
    b. SMACNA Leakage Class for Rectangular: 16.
    c. SMACNA Leakage Class for Round and Flat Oval: 8.

C. Return Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive or negative 2-inch wg.
b. SMACNA Leakage Class for Rectangular: 16.
c. SMACNA Leakage Class for Round and Flat Oval: 8.

2. Ducts Connected to Air-Handling Units:
a. Pressure Class: Positive or negative 2-inch wg.
b. SMACNA Leakage Class for Rectangular: 16.
c. SMACNA Leakage Class for Round and Flat Oval: 8.

3. Ducts Connected to Equipment Not Listed Above:
a. Pressure Class: Positive or negative 2-inch.
b. SMACNA Leakage Class for Rectangular: 16.
c. SMACNA Leakage Class for Round and Flat Oval: 8.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
a. Pressure Class: Negative 2-inch wg.
b. SMACNA Leakage Class for Rectangular: 16.
c. SMACNA Leakage Class for Round and Flat Oval: 8

2. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 2-inch wg.
b. SMACNA Leakage Class for Rectangular: 16.
c. SMACNA Leakage Class for Round and Flat Oval: 8.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive or negative 2-inch wg.
b. SMACNA Leakage Class for Rectangular: 16.
c. SMACNA Leakage Class for Round and Flat Oval: 8.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 2-inch wg.
b. SMACNA Leakage Class for Rectangular: 16
c. SMACNA Leakage Class for Round and Flat Oval: 2 8.

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 2-inch wg
b. SMACNA Leakage Class for Rectangular: 16
c. SMACNA Leakage Class for Round and Flat Oval: 8.

F. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

G. Liner:

1. Refer to article, Duct Liner.

H. Elbow Configuration:

1. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.

c. Round Elbows, 14 Inches and Larger in Diameter: Welded.

I. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.

b. Rectangular Main to Round Branch: Spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm or Lower: 90-degree tap.

b. Velocity 1000 to 1500 fpm: Conical tap.

c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 232113

This page intentionally left blank.

SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Manual volume dampers.
2. Combination fire and smoke dampers.
3. Flange connectors.
4. Duct silencers.
5. Turning vanes.
6. Remote damper operators.
7. Duct-mounted access doors.
8. Duct access panel assemblies.
9. Flexible connectors.
10. Duct accessory hardware.

B. Related Requirements:

1. Section 233346 "Flexible Ducts" for insulated and non-insulated flexible ducts.
2. Section 284620 "Fire Alarm" for duct-mounted fire and smoke detectors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.
b. Manual volume damper installations.
c. Control-damper installations.
d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.

e. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved. Refer to Section 23 00 50, “Common Work Results for HVAC Systems for additional requirements.

B. Source quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

A. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants, and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60.
2. Exposed-Surface Finish: Mill phosphatized.

C. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

D. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.

F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Aire Technologies.
    b. American Warming and Ventilating; a Mestek Architectural Group company.
    c. Flexmaster U.S.A., Inc.
    d. Flex-Tek Group.
    e. McGill AirFlow LLC.
    f. Nailor Industries Inc.
    g. Pottorff.
    h. Ruskin Company.
    i. Trox USA Inc.
    j. Vent Products Co., Inc.

2. Standard leakage rating, with linkage outside airstream.
3. Suitable for horizontal or vertical applications.
4. Frames:

    a. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel.
    b. Mitered and welded corners.
    c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Stiffen damper blades for stability.
    d. Stainless-steel, 0.064 inch thick.

6. Blade Axles: Stainless steel.
7. Bearings:

    a. Stainless-steel sleeve.
    b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Galvanized steel.

B. Low-Leakage, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. American Warming and Ventilating; a Mestek Architectural Group company.
    b. Flex-Tek Group.
    c. McGill AirFlow LLC.
    d. Nailor Industries Inc.
    e. Pottorff.

f. Ruskin Company.
g. Trox USA Inc.
h. Vent Products Co., Inc.

2. Comply with AMCA 500-D testing for damper rating.
3. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
4. Suitable for horizontal or vertical applications.
5. Frames:

a. Hat shaped.
b. 0.05-inch-thick stainless steel.
c. Mitered and welded corners.
d. Flanges for attaching to walls and flangeless frames for installing in ducts.

6. Blades:

a. Multiple or single blade.
b. Parallel- or opposed-blade design.
c. Stiffen damper blades for stability.
d. Stainless, roll-formed steel, 0.064 inch thick.

7. Blade Axles: Stainless steel.
8. Bearings:

a. Stainless-steel sleeve.
b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

9. Blade Seals: Neoprene.
10. Jamb Seals: Cambered stainless steel.
11. Tie Bars and Brackets: Aluminum.
12. Accessories:

a. Include locking device to hold single-blade dampers in a fixed position without vibration.

C. Jackshaft:

1. Size: 0.5-inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

D. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.4 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Aire Technologies.
2. American Warming and Ventilating; a Mestek Architectural Group company.
3. Cesco Products; a divsion of MESTEK, Inc.
4. Greenheck Fan Corporation.
5. Nailor Industries Inc.
6. Pottorff.
7. Ruskin Company.

B. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

D. Fire Rating: 1-1/2 hours.

E. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel, with welded corners and mounting flange.

F. Heat-Responsive Device: Electric resettable device and switch package, factory installed, rated.

G. Smoke Detector: Integral, factory wired for single-point connection.

H. Blades: Roll-formed, horizontal, interlocking, 0.034-inch-thick, galvanized sheet steel.

I. Leakage: Class I.

J. Rated pressure and velocity to exceed design airflow conditions.

K. Mounting Sleeve: Factory-installed, 0.05-inch-thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.

L. Master control panel for use in dynamic smoke-management systems.

M. Damper Motors: Modulating or two-position action.

N. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."
3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.

6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
7. Electrical Connection: 115 V, single phase, 60 Hz.

O. Accessories:

1. Auxiliary switches for position indication.
2. Test and reset switches, damper, remote mounted.

2.5 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. CL WARD & Family Inc.
2. Ductmate Industries, Inc.
3. Hardcast, Inc.
4. Nexus PDQ.
5. Ward Industries; a brand of Hart & Cooley, Inc.

B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

1.01 DUCT SILENCERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Dynasonics.
2. McGill AirFlow LLC.

B. General Requirements:

1. Factory fabricated.
2. Fire-Performance Characteristics: Adhesives, sealants, packing materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84.
3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. Shape:

1. Rectangular straight with splitters or baffles.

D. Rectangular Silencer Outer Casing: ASTM A 653/A 653M, G90, galvanized sheet steel, minimum 0.034 inch thick.

E. Inner Casing and Baffles: ASTM A 653/A 653M, G90 galvanized sheet metal, 0.018 inch thick, perforated.

F. Special Construction:

1. Suitable for outdoor use.
2. High transmission loss.

G. Connection Sizes: Match connecting ductwork unless otherwise indicated.

H. Principal Sound-Absorbing Mechanism:

1. Dissipative type with fill material.

a. Fill Material: Inert and vermin-proof fibrous material, packed under not less than 15 percent compression.
b. Erosion Barrier: Polymer bag enclosing fill, and heat sealed before assembly.

I. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations. Do not use mechanical fasteners for unit assemblies.

1. Joints: Lock formed and sealed.
2. Reinforcement: Cross or trapeze angles for rigid suspension.

J. Accessories:
1. Factory-installed end caps to prevent contamination during shipping.

K. Source Quality Control: Test according to ASTM E 477.

1. Record acoustic ratings, including dynamic insertion loss and generated-noise power levels with an airflow of at least 2000-fpm face velocity.
2. Leak Test: Test units for airtightness at 200 percent of associated fan static pressure or 6-inch wg static pressure, whichever is greater.

1.02 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Aero-Dyne Sound Control Co.
2. CL WARD & Family Inc.
3. Ductmate Industries, Inc.
4. Duro Dyne Inc.
5. Elgen Manufacturing.
6. Hardcast, Inc.
7. METALAIRE, Inc.
8. SEMCO LLC.
9. Ward Industries; a brand of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

D. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.6 REMOTE DAMPER OPERATORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Pottorff.
2. Ventfabrics, Inc.
3. Young Regulator Company.

B. Description: Cable system designed for remote manual damper adjustment.

C. Tubing: Aluminum.

D. Cable: Stainless steel.

E. Wall-Box Mounting: Recessed.

F. Wall-Box Cover-Plate Material: Stainless steel.

2.7 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Ductmate Industries, Inc.
2. Flexmaster U.S.A., Inc.
3. McGill AirFlow LLC.
4. Nailor Industries Inc.
5. Pottorff.
6. Ventfabrics, Inc.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:

a. Double wall, rectangular.
b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
c. Vision panel.
d. Hinges and Latches: 1-by-1-inchbutt or piano hinge and cam latches.
e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

    a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
    b. Access Doors up to 18 Inches] Square: Continuous and two sash locks.
    c. Access Doors up to 24 by 48 Inches: Continuous and two compression latches with outside and inside handles.
    d. Access Doors Larger Than 24 by 48 Inches: Continuous and two compression latches with outside and inside handles.

2.8 DUCT ACCESS PANEL ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. 3M.
2. Ductmate Industries, Inc.
3. Flame Gard, Inc.

B. Labeled according to UL 1978 by an NRTL.

C. Panel and Frame: Minimum thickness 0.0428-inch stainless steel.

D. Fasteners: Stainless steel. Panel fasteners shall not penetrate duct wall.

E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.

F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.9 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
1. Hardcast, Inc.
2. Ventfabrics, Inc.
3. Ward Industries; a brand of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd.
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

2.10 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel ducts.

C.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Set dampers to fully open position before testing, adjusting, and balancing.

E. Install test holes at fan inlets and outlets and elsewhere as indicated.

F. Install fire and smoke dampers according to UL listing and CSFM listing.

G. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. At outdoor-air intakes and mixed-air plenums.
3. At drain pans and seals.
4. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
5. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
6. At each change in direction and at maximum 50-foot spacing.

7. Upstream and downstream from turning vanes.
8. Upstream or downstream from duct silencers.
9. Control devices requiring inspection.
10. Elsewhere as indicated.

H. Install access doors with swing against duct static pressure.

I. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

J. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

K. Install flexible connectors to connect ducts to equipment.

L. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

M. Connect terminal units to supply ducts directly or with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.

N. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.

O. Connect flexible ducts to metal ducts with draw bands.

P. Install duct test holes where required for testing and balancing purposes.

Q. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

This page intentionally left blank.

SECTION 23 33 46 - FLEXIBLE DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Insulated flexible ducts.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For each type of product.
2. Product Data: For adhesives and sealants, indicating VOC content.

C. Shop Drawings: For flexible ducts.

1. Include plans showing locations and mounting and attachment details.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from installers of the items involved. Refer to Section 23 00 50, “Common Work Results for HVAC Systems for additional requirements.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

C. Comply with the Air Diffusion Council's "ADC Flexible Air Duct Test Code FD 72-R1."

D. Comply with ASTM E 96/E 96M, "Test Methods for Water Vapor Transmission of Materials."

2.2 MATERIALS

A. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants, and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).

2.3 INSULATED FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Flexmaster U.S.A., Inc.
2. JP Lamborn Co.
3. McGill AirFlow LLC.
4. Thermaflex; a Flex-Tek Group company.
5. Ward Industries; a brand of Hart & Cooley, Inc.

B. Insulated, Flexible Duct: UL 181, Class 1, two-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.
4. Insulation R-Value: R4.2.

2.4 FLEXIBLE DUCT CONNECTORS

A. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.

B. Non-Clamp Connectors: Adhesive plus sheet metal screws.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install flexible ducts according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install in indoor applications only. Flexible ductwork should not be exposed to UV lighting.

C. Connect terminal units to supply ducts directly or with maximum 12-inch of flexible duct. Do not use flexible ducts to change directions.

D. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.

E. Connect flexible ducts to metal ducts with draw bands.

F. Install duct test holes where required for testing and balancing purposes.

G. Installation:

1. Install ducts fully extended.
2. Do not bend ducts across sharp corners.
3. Bends of flexible ducting shall not exceed a minimum of one duct diameter.
4. Avoid contact with metal fixtures, water lines, pipes, or conduits.
5. Install flexible ducts in a direct line, without sags, twists, or turns.

H. Supporting Flexible Ducts:

1. Suspend flexible ducts with bands 1-1/2 inches wide or wider and spaced a maximum of 48 inches apart. Maximum centerline sag between supports shall not exceed 1/2 inch per 12 inches.
2. Install extra supports at bends placed approximately one duct diameter from center line of the bend.
3. Ducts may rest on ceiling joists or truss supports. Spacing between supports shall not exceed the maximum spacing per manufacturer's written installation instructions.
4. Vertically installed ducts shall be stabilized by support straps at a maximum of 72 inches o.c.

END OF SECTION 233346

This page intentionally left blank.

SECTION 233423 - HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Centrifugal roof ventilators.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on actual Project site elevations [**sea level**].

B. Operating Limits: Classify according to AMCA 99.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material thickness and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.
6. Roof curbs.
7. Fan speed controllers.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Roof framing and support members relative to duct penetrations.
2. Ceiling suspension assembly members.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Refer to Section 23 00 50, “Common Work Results for HVAC Systems for additional requirements.

B. Field quality-control reports.

C. Roof Curb Data: For roof mounted equipment where combined weight of equipment unit and roof curb or rail exceeds 400 pounds, submit calculations from manufacturer for roof curbs proving compliance with the seismic requirements of the 2016 CBC, and ASCE 7-10. Manufacturer shall certify that roof curbs are suitable for use indicated on Drawings and in Specifications for the seismic design category indicated in structural Contract Documents. Calculations shall be stamped and signed by a State of California registered structural engineer.

D. Provide evidence of equipment certification to California Energy Code Section 110.1 or 110.2, if not providing Electrically Commutated motors for HVAC fans sized below 1 hp and above 1/12 hp.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: One set(s) for each belt-driven unit.

1.8 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

1.9 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate sizes and locations of concrete bases with actual equipment provided.

C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants, and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).

2.2 CENTRIFUGAL ROOF VENTILATORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following, or equal:
   1. American Coolair Corporation.
   2. Loren Cook Company.

B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.

   1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains.
   2. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

D. Belt Drives:

   1. Resiliently mounted to housing.
   2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
   3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
   4. Pulleys: Cast-iron, adjustable-pitch motor pulley.
   5. Fan and motor isolated from exhaust airstream.

E. Accessories:

   1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
   2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
   3. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
   4. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

F. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

   1. Configuration: Built-in raised cant and mounting flange.
   2. Overall Height: 12 inches.

3. Sound Curb: Curb with sound-absorbing insulation.
4. Pitch Mounting: Manufacture curb for roof slope.
5. Metal Liner: Galvanized steel.
6. Mounting Pedestal: Galvanized steel with removable access panel.
7. Vented Curb: Unlined with louvered vents in vertical sides.

G. Controls: Refer to control diagrams on Drawings and to Section 230923, “Direct Digital Control System for HVAC.”

2.3 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

B. Enclosure Type: Totally enclosed, fan cooled.

C. For single-phase fan motors sized larger than 1/12 hp and smaller than 1 hp, refer to article, Single-Phase Motors, in Section 23 05 13, Common Motor Requirements for HVAC Equipment.

2.4 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Secure roof-mounted fans to roof curbs with stainless steel hardware. See Drawings for installation of roof curbs.

C. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

D. Install units with clearances for service and maintenance.

E. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Section 26 05 01 "Basic Electrical Materials and Methods."

D. Connect wiring according to Section 26 05 30, “Conduit and Wire.”

3.3 FIELD QUALITY CONTROL

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

END OF SECTION 233423

SECTION 233600 - AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Shutoff, single-duct air terminal units.
2. Casing liner.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of air terminal unit.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for air terminal units.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.

C. Shop Drawings: For air terminal units.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

D. Delegated-Design Submittal:

1. Materials, fabrication, assembly, and spacing of hangers and supports.

2. Include design calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports and seismic restraints.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension assembly members.
2. Size and location of initial access modules for acoustic tile.
3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
4. Refer to Section 23 00 50, “Common Work Results for HVAC Systems for additional requirements.

B. Field quality-control reports.

C. Provide evidence of equipment certification to California Energy Code Section 110.1 or 110.2, if not providing Electrically Commutated motors for HVAC fans sized below 1 hp and above 1/12 hp.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Instructions for resetting minimum and maximum air volumes.
b. Instructions for adjusting software set points.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

C. ASHRAE Compliance: Applicable requirements in ASHRAE/IES 90.1, "Section 6 - Heating, Ventilating, and Air Conditioning."

2.2 SHUTOFF, SINGLE-DUCT AIR TERMINAL UNITS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following, or equal:

1. Anemostat Products; a Mestek company.
2. Carnes Company.
3. ENVIRO-TEC; by Johnson Controls, Inc.
4. Krueger.
5. Nailor Industries Inc.

B. Configuration: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.

C. Casing: 22 gage galvanized steel, single wall.

1. Casing Liner: Comply with requirements in "Casing Liner" Article for fibrous-glass duct liner.
2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
3. Air Outlet: S-slip and drive connections, size matching inlet size.
4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.
5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Regulator Assembly: System-air-powered bellows section incorporating polypropylene bellows for volume regulation and thermostatic control. Bellows shall operate at temperatures from zero to 140 deg F, shall be impervious to moisture and fungus, shall be suitable for 10-inch wg static pressure, and shall be factory tested for leaks.

E. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: AHRI 880 rated, 3 percent of nominal airflow at 6-inch wg inlet static pressure.
2. Damper Position: Normally open.

F. Attenuator Section: 0.034-inch steel sheet.

1. Attenuator Section Liner: Comply with requirements in "Casing Liner" Article for fibrous-glass duct liner.
2. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

G. Hydronic Heating Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, and rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain valve.

H. Control devices shall be as specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."

1. Room Sensor: Wall mounted with temperature set-point adjustment and access for connection of portable operator terminal.

2.3 CASING LINER

A. Casing Liner: Fibrous-glass duct liner, complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Minimum Thickness: 1 inch.

a. Maximum Thermal Conductivity:
1) Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
3. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

a. Adhesive shall have a VOC content of 80 g/L or less.
b. product requirements of South Coast Air Quality Management District, Rule 1168.

2.4 SOURCE QUALITY CONTROL

A. Factory Tests: Test assembled air terminal units according to AHRI 880.

1. Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and AHRI certification seal.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 5, "Hangers and Supports" and with Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.

2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes and for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes and for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hangers Exposed to View: Threaded rod and angle or channel supports.

D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.2 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install hangers and braces designed to support the air terminal units and to restrain against seismic forces required by applicable building codes. Comply with CBC and ASCE/SEI 7, as referenced by the CBC. Comply with requirements for seismic-restraint devices in Section 230548 "Vibration and Seismic Controls for HVAC."

B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on air terminal units that are suspended with vibration isolators.

E. Install seismic-restraint devices using methods approved by the Office of Statewide Health Planning and Development for the State of California.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

G. Drilling for and Setting Anchors:

1. Identify position of reinforcing steel and other embedded items before drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Install heavy-duty sleeve anchors with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.3 TERMINAL UNIT INSTALLATION

A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

C. Install wall-mounted thermostats.

3.4 CONNECTIONS

A. Where installing piping adjacent to air terminal unit, allow space for service and maintenance.

B. Hot-Water Piping: Comply with requirements in Section 232113 "Hydronic Piping" and Section 232116 Hydronic Piping Specialties," and connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.

C. Comply with requirements in Section 233113 "Metal Ducts" for connecting ducts to air terminal units.

D. Make connections to air terminal units with flexible connectors complying with requirements in Section 233300 "Air Duct Accessories."

3.5 IDENTIFICATION

A. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections:

1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Air terminal unit will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.7 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
3. Verify that controls and control enclosure are accessible.
4. Verify that control connections are complete.
5. Verify that nameplate and identification tag are visible.
6. Verify that controls respond to inputs as specified.
7. .

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air terminal units. Provide minimum 2 hours training.

END OF SECTION 233600

This page intentionally left blank.

SECTION 23 37 13 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Submittal and installation requirements for diffusers, registers, and grilles.

B. Related Requirements:

1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.
6. Refer to Section 23 00 50, “Common Work Results for HVAC Systems for additional requirements.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 DIFFUSERS, REGISTERS, AND GRILLES

A. Diffusers, registers, and grilles manufacturers and models are specified on Drawings.

2.2 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

D. Unless otherwise indicated on Drawings, provide rectangular galvanized steel plenum on top of each diffuser and ceiling return for connection to ductwork. Line plenum with internal insulation as indicated for lined ductwork. Size plenum to allow full opening into air terminal. Plenum sheet metal gauge shall be equal to gauge for rectangular equivalent of the branch duct serving the air inlet or outlet.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

SECTION 234100 – PARTICULATE AIR FILTRATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Flat panel filters.
2. Pleated panel filters.
3. Filter gages.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include dimensions; operating characteristics; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each model indicated.

B. Shop Drawings: For air filters. Include plans, elevations, sections, details, and attachments to other work.

1. Show filter rack assembly, dimensions, materials, and methods of assembly of components.
2. Include setting drawings, templates, and requirements for installing anchor bolts and anchorages.
3. Wiring Diagrams: For power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of filter and rack to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Provide one complete set(s) of filters for each filter bank. If system includes prefilters, provide only prefilters.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance:

1. Comply with applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality"; Section 5 - "Systems and Equipment"; and Section 7 - "Construction and Startup."
2. Comply with ASHRAE 52.1 for arrestance and ASHRAE 52.2 for MERV for methods of testing and rating air-filter units.

C. Comply with NFPA 90A and NFPA 90B.

PART 2 - PRODUCTS

2.1 FLAT PANEL FILTERS

A. Description: Factory-fabricated, self-supported, flat, nonpleated, panel-type, disposable air filters with holding frames.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. AAF International.
b. Camfil Farr.
c. Flanders Corporation.
d. Purafil, Inc.

B. Filter Unit Class: UL 900, Class 2.

C. Media: Interlaced glass or synthetic fibers or Cotton and synthetic fibers coated with nonflammable adhesive.

1. Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
3. Media shall be coated with an antimicrobial agent.
4. Metal Retainer: Upstream side and downstream side.

D. Filter-Media Frame: Cardboard with perforated metal retainer sealed or bonded to the media.

E. Mounting Frames: Welded galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.

1. MERV Rating: As specified or scheduled for specific equipment, and tested according to ASHRAE 52.2.

2.2 PLEATED PANEL FILTERS

A. Description: Factory-fabricated, self-supported, extended-surface, pleated, panel-type, disposable air filters with holding frames.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. AAF International.
b. Camfil Farr.
c. Flanders Corporation.

B. Filter Unit Class: UL 900, Class 2.

C. Media: Interlaced glass or synthetic fibers or Cotton and synthetic fibers coated with nonflammable adhesive.

1. Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Media shall be coated with an antimicrobial agent.
3. Separators shall be bonded to the media to maintain pleat configuration.
4. Welded wire grid shall be on downstream side to maintain pleat.
5. Media shall be bonded to frame to prevent air bypass.
6. Support members on upstream and downstream sides to maintain pleat spacing.

D. Filter-Media Frame: Cardboard frame with perforated metal retainer with metal grid on outlet side and steel rod grid on inlet side, hinged, with pull and retaining handles sealed or bonded to the media.

E. Mounting Frames: Welded galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.

1. Minimum MERV Rating: As specified or scheduled for specific equipment, and tested according to ASHRAE 52.2.

2.3 FILTER GAGES

A. Diaphragm-type gage with dial and pointer in metal case, vent valves, black figures on white background, and front recalibration adjustment.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Airguard.
b. Dwyer Instruments, Inc.

2. Diameter: 2 inches.
3. Scale Range for Filter Media Having a Recommended Final Resistance of 0.5-Inch wg or Less: 0- to 0.5-inch wg.
4. Scale Range for Filter Media Having a Recommended Final Resistance of 0.5- to 1.0-Inch wg or Less: 0- to 1.0-inch wg.
5. Scale Range for Filter Media Having a Recommended Final Resistance of 1.0- to 2.0-Inch wg or Less: 0- to 2.0-inch wg.

6. Scale Range for Filter Media Having a Recommended Final Resistance of 2.0- to 3.0-Inch wg or Less: 0- to 3.0-inch wg.

B. Accessories: Static-pressure tips, tubing, gage connections, and mounting bracket.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.

B. Install filters in position to prevent passage of unfiltered air.

C. Install filter gage for each filter bank.

D. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.

E. Install filter-gage, static-pressure taps upstream and downstream from filters. Install filter gages on filter banks with separate static-pressure taps upstream and downstream from filters. Mount filter gages on outside of filter housing or filter plenum in an accessible position. Adjust and level inclined gages.

F. Coordinate filter installations with duct and air-handling-unit installations.

3.2 TEMPORARY (CONSTRUCTION PERIOD) FILTERS:

A. Install new temporary filters in all units that have filter systems installed. Temporary filters shall match the permanent filters that are specified for the units. Replace filters as needed, in accordance with manufacturer's directions, in order to provide protection for the unit prior to occupancy by the Owner. Provide new filters prior to air system balancing.

B. If air handling units are operated during construction of the project, install temporary filters directly over each return air inlet. Filters shall match the permanent filters that are specified for the units. Select size of filter to completely cover the frame of the return air inlet, and tape filters firmly in place to eliminate any construction debris from entering the duct system or unit. Remove the temporary filters upon completion of the work, and repair all damaged paintwork.

3.3 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate automatic roll filters to demonstrate compliance with requirements.
2. Test for leakage of unfiltered air while system is operating.

B. Air filter will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 CLEANING

A. After completing system installation and testing, adjusting, and balancing of air-handling and air-distribution systems, clean filter housings and install new filter media.

END OF SECTION 234100

This page intentionally left blank.

SECTION 235123 – GAS VENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Listed double-wall vents.
2. Boiler air intake piping.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for product.

B. Shop Drawings: For vents.

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail fabrication and assembly of hangers and seismic restraints.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

PART 2 - PRODUCTS

2.1 LISTED TYPE B VENTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Heat-Fab, Inc.
2. Metal-Fab, Inc.
3. Selkirk Corporation.

B. Description: Double-wall metal vents tested according to UL 441 and rated for 480 deg F continuously for Type B; with neutral or negative flue pressure complying with NFPA 211.

C. Construction: Inner shell and outer jacket separated by at least a 1/4-inch airspace.

D. Inner Shell: ASTM A 666, Type 430 stainless steel.

E. Outer Jacket: Galvanized steel.

F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

1. Termination: Stack cap designed to exclude minimum 90 percent of rainfall.

2.2 LISTED SPECIAL GAS VENTS – BOILER APPLICATION

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Heat-Fab, Inc. (Selkirk Corporation), model Saf-T Vent.
2. Metal-Fab, Inc..
3. ProTech Systems.
4. Securities Chimneys International.

B. Description: Double-wall metal vents tested according to UL 1738 and rated for 480 deg F continuously, with positive or negative flue pressure complying with NFPA 211. Vents shall be listed in boiler manufacturer's literature as acceptable for the boiler model scheduled on Drawings.

C. Construction: Inner shell and outer jacket separated by at least a 1/2-inch airspace.

D. Inner Shell: ASTM A 959, Type AL29-4C stainless steel.

E. Outer Jacket: Stainless steel.

F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, storm collars, support assemblies, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly. Provide boiler connection adapter of same manufacture as venting system, and listed as acceptable in boiler manufacturers literature.

1. Termination: Vent manufacturers' recommended cap designed to exclude minimum 90 percent of rainfall. Termination caps shall comply with boiler manufacturers' recommendations and shall be listed in boiler manufacturer's literature as acceptable for the boiler model scheduled on Drawings.
2. Condensate trap kit.

2.3 COMBUSTION AIR INTAKE PIPING – BOILER APPLICATION

A. Schedule 40, CPVC Plastic Pipe: ASTM F 441/F 441M.

1. CPVC Plastic Pipe Fittings: Socket-type pipe fittings, ASTM F 438 for Schedule 40.

B. Joining Materials:

1. Solvent Cements for CPVC Piping: ASTM F 493.

a. Solvent cement shall have a VOC content of 490 g/L or less.
b. Solvent cement shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

2. Adhesive primer shall have a VOC content of 550 g/L or less.
3. Adhesive primer shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATION

A. Listed Type B: Vents for certified gas appliances.

B. Listed Special Gas Vent: Boiler flue.

C. CPVC: Boiler combustion air intake.

3.3 INSTALLATION OF LISTED VENTS

A. Comply with requirements of boiler and vent system manufacturers.

B. Comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.

C. Seal between sections of positive-pressure vents according to manufacturer's written installation instructions, using sealants recommended by manufacturer.

D. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.

E. Lap joints in direction of flow. Slope vent towards appliance.

F. Install condensate trap kit and drain to receptacle.

3.4 PIPE JOINT CONSTRUCTION

A. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

3.5 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes.

END OF SECTION 235123

SECTION 235216

FIRE-TUBE CONDENSING BOILERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes packaged, factory-fabricated and -assembled, gas-fired, vertical, fire-tube condensing boilers, trim, and accessories for heating hot water.

1.3 SUBMITTALS

A. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: For boilers, boiler trim, and accessories.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Wiring Diagrams: Power, signal, and control wiring.

C. Source quality-control test reports: Indicate and interpret test results for compliance with performance requirements before shipping.

D. Field quality-control test reports: Indicate and interpret test results for compliance with performance requirements.

E. Warranty: Standard warranty specified in this Section.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For boilers to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Proposed models shall meet an established minimum manufacturer’s production period of 5 years.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code and so labeled with National Board Registration.

D. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."

E. AHRI Compliance: Boilers shall be AHRI listed and must meet the minimum efficiency specified under AHRI BTS-2000 as defined by Department of Energy in 10 CFR Part 431.

F. ANSI Compliance: Boilers shall be compliant with ANSI Z21.13 test standards for US.

G. CSA/UL Compliant: Boilers shall be compliant with CSA certification or UL listed.

H. All boiler models under 2,000 MBH shall be pre-certified with SCAQMD under Rule 1146.2. Units under 75,000 BTU must be compliant with Rule 1121.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.7 WARRANTY

A. Standard Warranty: Boilers shall include manufacturer's standard form in which manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Fire-Tube Condensing Boilers:

a. Heat Exchanger, Pressure Vessel and Condensation Collection Basin shall carry a 10 year limited warranty against defects in materials or workmanship and failure due to thermal shock.
b. All other components shall carry a two year warranty from date of boiler start up.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following, or equal:

1. AERCO.
2. Cleaver-Brooks.
3. Fulton.

2.2 CONSTRUCTION

A. Description: Boiler shall be natural gas fired, fully condensing, vertical, fire tube design. The boiler shall be factory-fabricated, factory-assembled, and factory-tested, fire-tube condensing boiler with heat exchanger

sealed pressure tight, built on a steel base; including insulated jacket; flue-gas vent; combustion-air intake connections; water supply, return, and condensate drain connections. Boiler shall be furnished with a negative regulated, fan assisted low NOx burner, automatic combustion system, safeties, controls, accessories and trim.

B. Heat Exchanger: Vertical single pass counter flow design. Heat exchanger shall bear the ASME "H" stamp for 160 psi working pressure and shall be National Board listed. The heat exchanger shall be constructed of a fully welded 316L or 439 welded stainless steel and of fire tube design.

1. Stainless steel fire-tubes capable of thermal expansion and contraction and welded into ASME grade top and bottom tube plates.

2. Minimum Flow and Volume:

a. Minimum flow rate for models less than 1,500 MBH shall be no greater than 18 GPM.
b. Minimum flow rate for models greater than 1,500 MBH shall be no greater than 25 GPM.
c. Minimum acceptable heat exchanger water volume of 1 US Gallon per 20,000 BTU input on all units over 1,000 MBH.

C. Condensate collection pan shall be solid 316L or 439 stainless steel of welded construction without bolts, gaskets or O-rings.

D. Intake Filter and Dirty Filter Switch: Boiler shall include an intake air filter with a factory installed air pressure switch. Boiler display screen shall alert the end user that the intake filter is dirty and needs to be changed.

E. Pressure Vessel: The pressure vessel shall be in accordance with ASME Section IV pressure vessel code. The pressure vessel shall be designed for single-pass water flow.

F. Gas Train, Burner and Combustion System: Negative Regulated Fan Assist Low NOx:

1. Burner: Natural gas, forced draft single burner premix design. Burner shall be high temperature stainless steel with a woven outer covering to provide modulating firing rates. The burner shall be capable of the stated gas train turndown without loss of combustion efficiency, ignition failures or flame rectification failures on run. The burner shall have an independent laboratory rating for Oxides of Nitrogen (NOx) to meet requirements of South Coast Air Quality Management District (SCAQMD) as compliant with Rule 1146.2.

a. Boilers greater than 1,000 MBH will have a minimum 20:1 burner modulation down to 5 percent input.
b. Negative regulated fan assist gas train using pulse width modulation fan signal and (2) gas valve firing system.

1) Low Fire gas valve shall track firing rates less than 50 percent for operation without flame rectification loss.
2) High Fire gas valve shall track firing rates greater than 50 percent for operation without flame rectification loss.

2. Gas train shall be equipped with High/Low Gas Pressure Switches, manually reset safety switched as required by CSD-1.
3. Combustion System will employ a flame safeguard system in compliance with CSD-1.
4. Ignition/Flame Supervision: Spark ignition with 100 percent main-valve shutoff with electronic flame supervision.

5. Boilers shall be able to operate within a dynamic range of 4 inch w.c.- 14 inch w.c. low gas pressure.

G. Blower: Boiler shall be equipped with a pulse width modulating blower system to control the fuel/air mixture to provide modulating boiler firing rates from 5 percent to 100 percent. The burner firing sequence of operation shall include pre-purge, firing, modulation, and post-purge operation.

1. Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

H. Gas Train: The boiler shall be supplied with two gas valves designed with negative pressure regulation and shall be capable of the following minimum turndowns:

I. Ignition: Spark ignition with 100 percent main-valve shutoff with electronic flame supervision.

J. Casing:

1. Jacket: Heavy gauge primed and painted steel jacket with snap-in closures.
2. Control Compartment Enclosures: NEMA 250, Type 1A.
3. Insulation: Minimum 1/2 inch thick, mineral fiber insulation surrounding the heat exchanger.
4. Combustion-Air Connections: Inlet and vent duct collars.

2.3 TRIM

A. Safety Relief Valve:

1. Size and Capacity: 50 lb.

2. Description: Fully enclosed steel spring with adjustable pressure range and positive shutoff; factory set and sealed.

B. Pressure Gage: Minimum 3-1/2 inch diameter. Gage shall have normal operating pressure about 50 percent of full range.

C. Drain Valves: Minimum NPS 3/4 or nozzle size with hose-end connection.

D. Condensate Neutralization Kit: Factory supplied condensate trap with condensate trip sensor, high capacity condensate receiver prefilled with appropriate medium.

2.4 ACCESSORIES

A. Provide unit with kit required for outside installation.

2.5 CONTROLS

A. Refer to Section 23 09 23 "Direct Digital Control System for HVAC."

B. Boiler controls shall feature a standard, factory installed LCD screen display with the following standard features:

1. Variable Speed Boiler Pump Control: Boiler may be programmed to send a 0-10V DC output signal to an ECM or VFD boiler pump to maintain a designed temperature rise across the heat exchanger. The boiler shall be able to operate in this mode with a minimum temperature rise of 20 degrees F and a maximum temperature rise of 60 degrees F.

2. Isolation valve control: Boiler shall have the ability to control a 2-way motorized control valve. Boiler shall also be able to force a fixed number of valves to always be energized regardless of the number of boilers that are firing.

3. BMS integration with 0-10V DC input: The Control shall allow an option to Enable and control set point temperature or control firing rate by sending the boiler a 0-10V input signal.

4. Data logging: Boiler shall have non-volatile data logging memory including last 10 lockouts, hours running and ignition attempts and should be able to view on boiler screen.

5. Boiler shall have a built in Cascade controller to sequence and rotate lead boiler to ensure equal runtime while maintaining modulation of up to 8 boilers of different btu inputs without utilization of an external controller. Factory installed, internal cascade controller shall include: Lead-Lag, Parallel Modulation, Series Modulation, Rotation of Lead Boiler, Set-Point Adjustment.

6. Controller shall have an outdoor reset feature to reset water temperature based on outdoor air temperature.

7. Controller shall have a night time setback feature programmable to lower water temperature during non-occupancy periods.

8. Burner Control:

    a. High Temperature Limit: Automatic and manual reset stops burner if operating conditions rise above maximum boiler design temperature. Limit switch to be manually reset on the control interface.
    b. Low-Water Cutoff Switch: Electronic probe shall prevent burner operation on low water. Cutoff switch shall be manually reset on the control interface.
    c. Blocked Air Inlet Safety Switch: Manual-reset pressure switch field mounted on boiler combustion-air inlet.
    d. High and Low Gas Pressure Switches: Pressure switches shall prevent burner operation on low or high gas pressure. Pressure switches to be manually reset on the control interface.
    e. Blocked Condensate Drain Switch: Blocked drain switch shall prevent burner operation when tripped. Switch to be manually reset on the control interface.
    f. Low air pressure switch: Pressure switches shall prevent burner operation on low air pressure. Switch to be manually reset on the control interface.
    g. Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for any lockout conditions.

C. Building Automation System Interface: Factory installed gateway interface to enable building automation system to monitor, control, and display boiler status and alarms. BACnet MS/TP will be standard.

2.6 ELECTRICAL POWER

A. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.

B. Single-Point Field Power Connection: Factory-installed and factory-wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.

C. Electrical Characteristics:

1. Refer to schedule on Drawings.

2.7 VENTING

A. Exhaust flue must be UL listed, Category IV approved stainless steel sealed vent material from one of the approved manufacturers listed in the Installation and Operation manual. Boilers exhaust vent length must be able to extend to 100 equivalent feet. Refer to Section 23 51 23, “Gas Vents,” for exhaust flue materials.

B. Intake piping shall be of approved material as listed in the Installation and Operations manual. Boilers intake pipe length shall be able to extend to 100 equivalent feet. Refer to Section 23 51 23, “Gas Vents,” for intake piping and joining methods.

C. Boiler venting and intake piping configuration shall be installed per one of the approved venting methods shown in the Installation and Operation manual.

D. Boiler shall come standard with a flue sensor to monitor and display flue gas temperature on factory provided control display.

E. Refer to manufacturer’s Installation and Operations manual for detailed venting instructions and approved manufacturers.

2.8 SOURCE QUALITY CONTROL

A. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.

B. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before boiler installation, examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting boiler performance, maintenance, and operations.

1. Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in of piping and electrical connections.

B. Examine mechanical spaces for suitable conditions where boilers will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 BOILER INSTALLATION

A. Install equipment on 4” concrete housekeeping pad. Refer to detail on Drawings.

B. Install gas-fired boilers according to NFPA 54.

C. Assemble and install boiler trim.

D. Install electrical devices furnished with boiler but not specified to be factory mounted.

E. Install control wiring to field-mounted electrical devices.

3.3 CONNECTIONS

A. Install boilers level on concrete bases. Concrete materials and installation requirements are specified in Section 03 30 00 “Cast-in-Place Concrete.”

B. Install piping adjacent to boiler to allow service and maintenance.

C. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.

D. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of equipment connection. Provide a reducer if required.

E. Connect hot-water piping to supply and return boiler tappings with shutoff valve and union or flange at each connection.

F. Install piping from safety relief valves to nearest floor drain.

G. Boiler Venting:

1. Install flue venting kit and combustion-air intake.

2. Connect full size to boiler connections. Comply with requirements in Division 23 Section “Gas Vents.

H. Ground equipment according to Section 26 05 01 "Basic Electrical Materials and Methods."

I. Connect wiring according to Section 26 05 30 "Conduit and Wire."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Perform installation and startup checks according to manufacturer's written instructions. Complete startup form included with Boiler and return to Manufacturer as described in the instructions.

2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.

3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

   a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level and water temperature.
   b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

D. Performance Tests:

1. Engage a factory-authorized service representative to inspect component assemblies and equipment installations, including connections, and to conduct performance testing.

2. Boilers shall comply with performance requirements indicated, as determined by field performance tests. Adjust, modify, or replace equipment to comply.

3. Perform field performance tests to determine capacity and efficiency of boilers.

4. Repeat tests until results comply with requirements indicated.

5. Provide analysis equipment required to determine performance.

6. Provide temporary equipment and system modifications necessary to dissipate the heat produced during tests if building systems are not adequate.

7. Notify Architect in advance of test dates.

8. Perform a combustion analysis after installation and adjust gas valve per the Installation and Operations manual and note in startup report.

9. Document test results in a report and submit to Architect.

3.5 DEMONSTRATION

A. Engage a factory representative or a factory-authorized service representative for boiler startup and to train Owner's maintenance personnel to adjust, operate, and maintain boilers. Refer to Section 01 79 00 "Demonstration and Training." Provide minimum 2 hours training.

END OF SECTION 235216

This page intentionally left blank.

SECTION 237313 -CUSTOM AIR HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Custom variable volume air handling units.

1.3 ACTION SUBMITTALS

A. Product Data: For each air-handling unit.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
3. Include unit dimensions and weight.
4. Include cabinet material, metal thickness, finishes, insulation, and accessories.
5. Fans:

    a. Include certified fan-performance curves with system operating conditions indicated.
    b. Include certified fan-sound power ratings.
    c. Include fan construction and accessories.
    d. Include motor ratings, electrical characteristics, and motor accessories.

6. Include certified coil-performance ratings with system operating conditions indicated.
7. Include dampers, including housings and linkages.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and other details, drawn to scale, showing the items described in this Section, and coordinated with all building trades. Refer to Section 23 00 50, “Common Work Results for HVAC Systems for additional requirements.

B. Sample Warranty: For manufacturer's warranty.

C. Source quality-control reports.

D. Startup service reports.

E. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-handling units to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set(s) for each air-handling unit.
2. Gaskets: One set(s) for each access door.

1.7 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air- handling units and components.

C. ARI Certification: Air-handling units and their components shall be factory tested according to ARI 430, "Central-Station Air-Handling Units," and shall be listed and labeled by ARI.

D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

E. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1- 2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."

F. Comply with NFPA 70.

1.8 WARRANTY

A. Manufacturer shall provide, at no additional cost, a standard parts warranty that covers a period of one year from unit start-up or l8 months from shipment, whichever occurs first.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Scott Springfield.
2. Haakon.
3. Climate Craft.

2.2 UNIT CONSTRUCTION

A. Unit Base:

1. Each unit shall be constructed on a base fabricated from ASTM A36 welded structural steel channel. Tubular or formed metal channel bases are not acceptable.
2. Maximum Deflection: L-200.

B. Unit Cabinet

1. Housing: The unit housing side and roof panels shall be constructed of 16-gauge galvanized steel, and shall utilize a standing seam modular panel type construction. All floors shall be constructed of 14-gauge galvanized steel. The panels shall be caulked and attached to each other, to the roof, and to the floor using nuts and bolts on no less than 8 inches on center. Drive screw attachment is not acceptable. All panels shall be removable. All seams shall be sealed with an acrylic latex sealant prior to assembling the panels and after completion of the assembly. All floor openings shall have 12-gauge galvanized steel-framed flange around the entire perimeter of opening for duct connection.

2. Insulation and Interior Liner: Insulation shall be 2 inches thick, 3 lbs per cubic foot density, neoprene coated fiberglass to cover all walls and ceilings. Insulation shall meet NFPA-90A smoke and flame spread requirements. All floors shall be insulated from below using minimum 2 inch thick foam to ensure that the entire under surface of the floor is insulated. There shall be no raw edges of insulation exposed to the air stream. The entire interior of all units shall be lined with minimum 20 gauge galvanized steel liner. The interior liner of the fan sections, inlet plenum sections, and discharge plenum sections shall be perforated and the remaining shall be steel.
3. Drain Pans: Drain pans shall be constructed from 16-gauge, 316 stainless steel. Drain pan shall be insulated with minimum 2 inch thick foam insulation. Drain pans shall be sized such that the entire coil, including headers and return bends, are inside the drain pan. Drain pans shall slope in two directions so there is no standing water in drain pan. Stainless steel condensate connection shall be provided on one side of the unit.

C. Access Doors

1. All access doors shall be of thermal break construction, hinged, double wall, insulated, man size access doors shall be provided in all sections requiring access for maintenance or service. The frame shall be constructed of extruded aluminum, fully welded at the corners with an anodized finish. The doors shall utilize a dual gasket seal system. All hardware provided shall be non-corrosive and all hinges and latches shall be adjustable with nuts and bolts. Access door must not leak more than 25 CFM at 6 inches static pressure.
2. Door hinges and latches shall be adjustable, without the use of shims or special tools, to allow for a tight seal between the door and the doorframe. The door hinge design shall allow for field reversing of door swing and doors shall be removable. Provide door detail drawing with submittal package.
3. Doors providing access to any section of the air handler that contains rotating fans shall be provided with a door interlock safety switch to de-energize the fan motor upon opening. Each fan section shall include an 8 inch x 12 inch wire reinforced UV protected glass view window in the access door.

D. Paint Finish

1. After final assembly the unit exterior shall be coated with an industrial grade self- priming semi-gloss high solids polyurethane gray finish. All fan bases, springs, and structural steel

supports shall be coated with the same finish. The paint system shall meet ASTM B117 Salt spray test for a minimum of 2000 hours.

2.3 INTERNAL COMPONENTS

A. Fan Assembly

1. Supply and return fans shall be direct drive Arrangement No. 4 plenum fans. Fan wheel shall be aluminum with aluminum extruded airfoil blades. The fan inlet shall be isolated from the cabinet by means of a neoprene-coated flexible connection. Plenum fans shall be provided with spring-style thrust restraints.
2. Each fan shall be sized to perform as indicated on the Drawings equipment schedule. The wheel diameter shall not be less than that shown on the equipment schedule. Fans shall be tested in accordance with AMCA 210 and AMCA 301 test codes for air moving devices and shall be guaranteed by the manufacturer to deliver rated published performance levels. Fans shall be licensed to bear the AMCA certified ratings seal for both sound and air. Fans shall have a sharply rising pressure characteristic extending through the operating range and continuing to rise beyond the efficiency peak to ensure quiet and stable operation. Fans shall have a non- overloading design with self-limiting horsepower characteristics and shall reach a peak in the normal selection area. All fans shall be capable of operating over the minimum pressure class limits, as specified in AMCA Standard 2408-69.
3. Fan Base, Spring Isolation, and Support Framing: Mount fan and motor on an internal, fully welded, rigid steel base. Base shall be free-floating at all four corners on spring type isolators with earthquake restraints. The fan assembly shall be isolated from the cabinet by steel springs with minimum deflection of 2.0 inches or as indicated on schedules. The spring isolators shall be mounted to structural steel members. All isolators shall be rated for zone 4 seismic requirements. The spring isolators shall be mounted on a waffle pad for vibration isolation.
4. Balancing: All fans prior to shipment shall be completely assembled and test run as a unit at the specified operating speed or maximum RPM allowed for the particular construction type. Each wheel shall be statically and dynamically balanced in accordance with ANSI/AMCA 204-96 "Balance Quality and Vibration Levels for Fans" to Fan Application Category BV-3, Balance Quality Grade G6.3. Balance readings shall be taken by electronic type equipment in the axial, vertical, and horizontal directions on each of the bearings. Records shall be maintained and a written copy shall be available upon request.

B. Motors:

1. Furnish premium-efficiency TEFC, NEMA frame, ball bearing type motors. TECO, Marathon "XRI", or Reliance "XE" Premium Efficiency are acceptable. The Horsepower values as shown on the schedule are minimum allowable.
2. The fan motors shall be factory wired to an external VFD with flexible conduit of adequate length so that it will not have any effect on the vibration isolation.

C. Fan Airflow Measurement:

1. Manufacturer shall be Ebtron, Fan Inlet Hybrid Series or equal.
2. Each fan shall have a sensor face mounted at the inlet cone. Sensor shall not affect fan performance or sound. Each sensor node shall be shall contain two individually wired, hermetically sealed bead-in-glass thermistors. Airflow accuracy shall be plus or minus 2 percent of reading over the entire operating airflow range of not less than 0 to 5,000 fpm.
3. A single transmitter shall be provided for each bank of fans with an integral, minimum l6-character LCD display capable of simultaneously displaying total airflow and temperature.

The LCD display shall also be capable of displaying individual fan airflow and temperature readings of each independent sensor node.

4. Output signal 4-20 mA. DC or 0-5 VDC standard.
5. The transmitter shall be housed in a NEMA 1enclosure with external signal tubing, power and output signal connections.

D. Coils

1. Chilled water coils shall be of the plate fin extended surface type. Tubes shall be 5/8 inch outside diameter seamless copper with a 0.020 inch minimum wall thickness. Each coil shall have individually replaceable return bends of 0.025 inch wall thickness on both sides of the coil. Coils incorporating a "hairpin" type design are not acceptable. Tubes shall be expanded into the fin collars to provide a permanent mechanical bond.
2. The secondary surface shall be formed of 0.008 inch aluminum fins and shall be spaced not closer than 12 fins per inch with integral spacing collars that cover the tube surface. Headers shall be non-ferrous seamless copper, outside the air stream and provided with brazed copper male pipe connections. Drain and vent tubes shall be extended to the exterior of the air handling unit.
3. All coils shall have counter flow construction with connections left or right hand as shown on the drawings. The use of internal restrictive devices to obtain turbulent flow will not be accepted.
4. Cooling coil casings shall be of minimum 16-gauge, 316 stainless steel with double- formed 1-1/4 inches stacking flanges and 3/4 inch flanges on the side plates. All other coil casing shall be of 16-gauge galvanized steel. Flanged tube sheets shall have extruded tube holes. Reinforcing shall be furnished so that the unsupported length is not over 60 inches. All coil assemblies shall be tested under water at 300 psi and rated for 150-psi working pressure. Headers are to be located inside the cabinet casing with only the pipe connections extending through the casing. All sides of coils shall be carefully blanked off with the same materials used for the coil casings, to ensure all air passes through the coil.
5. Intermediate condensate pans are to be furnished on multiple coil units and single coils greater than 48 inches high. The pans shall be 16 Ga. 304 stainless steel and drain to the main drain pan through copper downspouts.
6. All water coils shall be rated in accordance with ARI Standard 410.

E. Filters

1. Filter sections shall be fabricated as part of the air-handling unit Filters shall be arranged for upstream loading as shown on the drawings. Provide filter-holding frames to accommodate scheduled filters. Filter frames shall be 16 Ga. galvanized steel and shall be fully welded to reduce leakage of air through corners.
2. Factory install at each filter bank a Dwyer Magnehelic "Series 2000 ASF," or equal pressure gauge complete with signal flags, static pressure tips, hardware and fittings. Enclose the gauge in a protective sheet metal box with a hinged inspection door. Paint to match unit
3. Filter shall be mini-pleat high-efficiency, extended media area, totally rigid and disposable type. Air filters shall be MERV 13 and have average efficiency of not less than 85 percent when tested in accordance with ASHRAE 52-76 test standard. Filter pressure drop shall not exceed 0.30 inches at 500 FPM when clean. Filter shall be of the quantities and sizes as indicated on the drawings

F. Economizer Section

1. Economizer section shall include dampers for return air, fresh air and exhaust air. Dampers shall be opposed blade type. Dampers shall be sized for not greater than 1200 fpm face velocity based upon gross damper area. Dampers shall meet above specifications. Furnish full height 24 inches wide access doors for damper and linkage service.

2. Dampers shall be supplied with low leak extruded aluminum airfoil blades. Blades shall be supplied with rubber edge seals and stainless steel arc end seals. Rubber edge seals shall be backed by the damper blade to assure a positive seal in the closed position. Dampers shall be provided with nylon bearings within extruded openings. Damper leakage shall not exceed 6 CFM/ft2 at 5.0 inches of static pressure. Leakage testing shall be in accordance with AMCA standard 500 figure S.S. Test results must be from independent testing laboratory.

G. Outside Air Monitoring System

1. EBTRON, Inc. Model GTC116-PC is basis of design. (ATMD)

   a. Products submitted as equal in non-conformance with the requirements of this specification will not be considered.
   b. Any product submitted as an equal shall comply with all performance, capabilities and functional aspects of this specification.

2. Each ATMD shall consist of one or more sensor probes and a single, remotely mounted, 32 bit microprocessor-based transmitter capable of independently processing up to 16 independently wired sensor nodes contained in one or more probe assemblies per
3. Probes shall be constructed of extruded, gold anodized, 6063 aluminum tubes. All internal wires within the tube shall be Kynar coated. PVC insulated conductors are not acceptable.
4. Each sensor node shall contain two individually wired, hermetically sealed bead-in- glass thermistors.
5. Thermistors shall be mounted in the sensor node using a marine-grade, waterproof epoxy. Thermistor leads shall be protected and not exposed to the environment. Thermistors leads shall not be fastened to the thermistor semiconductor substrate by weld or solder connections. Manufacturer shall provide UL listed, FEP jacketed, plenum rated cable(s) between sensor probes and the remote transmitter.
6. The airflow rate at each sensor node shall be equally weighted and arithmetically averaged by the transmitter prior to output. All integrated circuitry shall be temperature rated as 'industrial -grade'. Submissions containing 'commercial-grade' integrated circuitry are not acceptable.
7. Each sensing node shall be individually wind tunnel calibrated at l6 points to NIST traceable airflow standards. Airflow accuracy shall be plus or minus 2 percent of reading over the entire operating airflow range of not less than 0 to 5,000 fpm (25.4 m/s).
8. The transmitter shall have an integral LCD display capable of simultaneously displaying airflow and temperature. Individual airflow and temperature readings of each independent sensor node shall be accessible. The transmitter shall be capable of field configuration and diagnostics using an on-board pushbutton interface and LCD display.
9. The ATMD shall be UL 973 and BTL listed
10. The transmitter shall have two isolated and fused analog output signals and one RS- 485 network connection. One analog output shall be for velocity and the other for a temperature output or LEED alarm function. All transmitters shall have integral self diagnostics.
11. Other than the thermistor sensors, no other electronic components shall be located at the sensing node. Signal processing circuitry on or in the sensor probe shall not acceptable.
12. Devices using chip-in-glass, epoxy-coated or diode-case chip thermistors are not acceptable.
13. Devices with RJ-45 connections exposed to the environment or having electronic circuitry mounted in or at the sensor node are not acceptable.
14. Pitot tubes and arrays are not acceptable.
15. Vortex shedding devices are not acceptable.

H. Electrical Requirements

1. All AHU and electrical panel wiring shall be performed in a UL 508 listed shop. Provide single source power panels (SSPP's) that are constructed according to NEC regulations and carry a U.L.508 listing and label and installed in a NEMA3R enclosure. The panel shall include a non-fused main disconnect switch covering all fans in each unit, Motor Starters for constant volume units or VFD's for variable volume units, and any necessary transformers, Hand-Off-Auto switches, relays and pilot lights for complete operation of the fans in the unit. The single source power panels shall be factory wired to all factory furnished devices such as motors and interlocks.
2. The air handling unit manufacturer, for the purpose of sole source responsibility, shall manufacture all electrical panel assemblies supplied for the air handlers. The air handling unit manufacturer shall be a U.L. 508 listed panel shop.
3. The main control panel shall have access door(s) for direct access to the controls. The panel shall contain a single externally operated, non-fused disconnect, suitable for copper wire up to and including 3 inches diameter conduit. Connect separate 460/3/60 power to the single source power panel.
4. All wiring shall be run in EMT conduit, (or flexible when connecting to a motor), raceways are not acceptable.
5. Provide fluorescent, marine style lights in each access section wired to a common weatherproof switch with 60-minute timer mounted adjacent to the supply fan access door. 120V GFI duplex service receptacles shall be installed and wired with the lighting circuit and located in each fan compartment.
6. If the unit requires splits, junction boxes shall be furnished on each section to allow the electrical contractor to make final connections in the field. Wiring shall be clearly labeled to allow ease in final interconnections.

I. Variable Frequency Drives

1. Furnish complete individual variable frequency VFDs for each fan designated on the drawing schedules to be variable speed to be installed inside the unit's vestibule. Comply with requirements in Section 232923, "Variable Frequency Motor Controllers."

2.4 CONTROLS

A. Refer to control diagrams on Drawings and to Section 230923, “Direct Digital Control System for HVAC.”

2.5 SOURCE QUALITY CONTROL

A. Fan Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Fans shall bear AMCA-certified sound ratings seal.

B. Fan Performance Rating: Factory test fan performance for airflow, pressure, power, air density, rotation speed, and efficiency. Rate performance according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating."

C. Water Coils: Factory tested to 300 psig according to ARI 410 and ASHRAE 33.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine casing insulation materials and filter media before air-handling unit installation. Reject insulation materials and filter media that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for hydronic and condensate drainage piping systems and electrical services to verify actual locations of connections before installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 I NSTALLATION, GENERAL

A. Unit Support: Install unit level on concrete structural pads. Coordinate roof penetrations and flashing with roof construction. Secure units to structural support with anchor bolts. Coordinate sizes and locations of concrete structural pads with actual equipment provided.

B. Arrange installation of units to provide access space around air-handling units for service and maintenance.

C. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with new, clean filters.

D. Connect duct to air-handling units with flexible connections. Comply with requirements in Section 233300 "Air Duct Accessories."

3.3 PIPING CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to air-handling unit, allow space for service and maintenance.

C. Connect condensate drain pans using size shown on Drawings, ASTM B 88, Type M copper tubing. Extend to nearest equipment or floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

D. Hot- and Chilled-Water Piping: Comply with applicable requirements in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties." Install shutoff valve and union or flange at each coil supply connection. Install balancing valve and union or flange at each coil return connection.

3.4 ELECTRICAL CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 26 05 01 "Basic Electrical Materials and Methods."

C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Division 26 Sections.

3.5 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring according to Section 26 05 30 "Conduit and Wire."

3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that shipping, blocking, and bracing are removed.
3. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, controllers, and switches.
4. Verify proper motor rotation direction, free fan wheel rotation, and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.
5. Verify that bearings, pulleys, belts, and other moving parts are lubricated with factory-recommended lubricants.
6. Verify that zone dampers fully open and close for each zone.
7. Verify that face-and-bypass dampers provide full face flow.
8. Verify that outdoor- and return-air mixing dampers open and close, and maintain minimum outdoor-air setting.
9. Comb coil fins for parallel orientation.
10. Verify that proper thermal-overload protection is installed for electric coils.
11. Install new, clean filters.
12. Verify that manual and automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.

B. Starting procedures for air-handling units include the following:

1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm.
2. Measure and record motor electrical values for voltage and amperage.
3. Manually operate dampers from fully closed to fully open position and record fan performance.

3.7 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.

C. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.8 CLEANING

A. After completing system installation and testing, adjusting, and balancing air-handling unit and air-distribution systems and after completing startup service, clean air-handling units internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.9 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Air-handling unit and components will be considered defective if unit or components do not pass tests and inspections.

C. Prepare test and inspection reports.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-handling units. Provide minimum 2 hours training.

END OF SECTION 237313

SECTION 238126.13 – VARIABLE REFRIGERANT FLOW SPLIT-SYSTEM HEAT PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes variable refrigerant flow split-system heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Sustainable Design Submittals:

1. Product Data: For refrigerants.
2. Product Data: For energy performance.

C. Product Data for California Green Building Standards Code Compliance: For adhesives and sealants, including primers, documentation of compliance including printed statement of VOC content and chemical components.

D. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

E. Samples for Initial Selection: For units with factory-applied color finishes.

1.4 INFORMATIONAL SUBMITTALS

A. Provide evidence of equipment certification to California Energy Code Section 110.1 or 110.2, if not providing Electrically Commutated motors for HVAC fans sized below 1 hp and above 1/12 hp. Refer to Section 230513, “"Common Motor Requirements for HVAC Equipment."

B. Training Certificates of Completion: Submit certificate from equipment manufacturer, indicating attendance and successful completion of manufacturer’s training program for variable refrigerant flow systems

installation and service. Training shall include manufacturer's preferred methods for assembling and insulating refrigerant piping and accessories.

C. Submit system documentation for a fully engineered system, including shop drawings, and wiring and control diagrams, showing location of required manufactured system components, component model numbers and capacities, and size and location of all field-installed components, including piping, required expansion compensation devices, and wiring. Identify proposed deviations from system as shown in Contract Documents.

D. Coordination Drawings: Plans, drawn to scale at 1/4 inch equals one foot, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. System installation, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to system layout.
2. Suspended ceiling components.
3. Structural members to which system components will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Perimeter moldings.

7. Refer to Section 23 00 50, "Common Work Results for HVAC Systems for additional requirements.

E. Roof Curb Data: For roof mounted equipment where combined weight of equipment unit and roof curb or rail exceeds 400 pounds, submit calculations from manufacturer for roof curbs proving compliance with the seismic requirements of the 2016 California Building Code, and ASCE 7-10. Manufacturer shall certify that roof curbs are suitable for use indicated on Drawings and in Specifications for the seismic design category indicated in structural Contract Documents. Calculations shall be stamped and signed by a State of California registered structural engineer.

F. Field quality-control reports.

G. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: Two set(s) of disposable filters for each air-handling unit indicated to accommodate disposable filters. One washable, permanent filters for each air handling unit designed to accommodate washable, permanent filters.

1.7 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 - "Construction and System Start-up."

C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.

D. Variable Refrigerant Flow Split-System Heat Pump Installer Training: Installing contractor shall have completed training in installation and service of VRF system, by equipment manufacturer.

1. Installing contractor shall obtain, at his own cost, equipment manufacturer’s VRF system service tool, unless service tool is normally resident on controller specified for this Project.

1.8 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants, and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).

2.2 MANUFACTURERS

A. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following, or equal:

1. Carrier/Toshiba.
2. Daikin.
3. Mitsubishi.

2.3 INDOOR UNITS

A. General:

1. Galvanized steel casing.
2. Ducted, ceiling-recessed, or in-room units per Drawings schedule. Available styles shall include:

    a. Concealed (ducted) units:
        1) Horizontal/Vertical air handling unit for closet or above-ceiling installation.
        2) Ceiling concealed.
        3) Ceiling concealed, with high-static option.

3. Factory assembled and tested with factory wiring, piping, expansion valve, control circuit board, and fan motor. Units shall have, as a minimum, the following functions:

    a. Self-diagnostic function.
    b. Auto restart function.
    c. Auto changeover function.
    d. Emergency operation function.
    e. 3-minute time delay shall provide minimum 3 minute run time for cooling and heating.

4. Indoor unit and refrigerant pipes shall be charged with dehydrated air prior to shipment from the factory.
5. The indoor units shall be equipped with a return air thermistor.

B. Unit Cabinet:

1. The cabinet shall be insulated with foamed polystyrene and polyethylene insulation.

C. Fan:

1. The fan shall be direct-drive type, statically and dynamically balanced impeller with multiple high and low fan speeds. Auto fan setting shall automatically adjust fan speed.
2. The fan motor shall be thermally protected.
3. The fan motor shall be equipped as standard with adjustable external static pressure (ESP) settings.
4. For single-phase fan motors sized larger than 1/12 hp and smaller than 1 hp, refer to Article, Electric Motors, in Section 23 05 13, “Common Motor Requirements for HVAC Equipment.”
5. All units shall be provided with a condensate drain pan below the coil. Drain pans shall have primary and overflow drains.

D. Coil:

1. Coils shall be aluminum fins bonded to internally grooved copper tubes. Fins shall have corrosion-resistant coating.

2. The coils shall be pressure tested at the factory.
3. Unit shall be provided with ball-type refrigerant service valves at each refrigerant piping connection.
4. A condensate pan and drain connections shall be provided under the coil. Provide overflow cutoff switch to disable unit during overflow condition.

E. Filters:

1. Concealed (ducted) units mixing boxes shall include filter rack designed to accommodate disposable filters, as specified in Drawings schedules and in Section 234100, “Particulate Air Filtration.”

F. Controls:

1. Units shall have controls provided by the manufacturer to perform input functions necessary to operate the system.
2. Operating modes shall include Auto Changeover (heat recovery systems only), Heating, Cooling, Dry, and Fan Only.
3. Units shall be compatible with a BMS system via optional LonWorks or BACnet gateways.

2.4 OUTDOOR CONDENSING UNITS

A. General:

1. Condensing unit shall be factory assembled and pre-wired with all necessary electronic and refrigerant controls. The refrigeration circuit of the condensing unit shall consist of scroll compressors, motors, fans, condenser coil, electronic expansion valves, solenoid valves (when required by manufacturer), 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports and refrigerant accumulator and regulator.
2. The following safety devices shall be included as part of the condensing unit; high pressure sensor and switch, low pressure sensor, control circuit fuses, over- and under-current protection, phase failure and phase reversal protection, fusible plug or pressure relief valve, and crankcase heater.
3. The system will automatically restart operation after a power failure without loss of settings.
4. The condensing units shall be modular in design and allow for side-by-side installation with minimum spacing. Provide kit for field piping between connected condensing units. Refer to Drawings schedules and diagrams for connected units.
5. To ensure the liquid refrigerant does not flash when supplying to indoor units, the circuit shall be provided with a sub-cooling feature.
6. Oil recovery cycle shall be automatic occurring 2 hours after start of operation, and thereafter every 8 hours of operation. Each system shall maintain continuous heating during oil return operation. Reverse cycle (cooling mode) oil return during heating operation shall not be permitted due to the potential reduction in space temperature.
7. The condensing unit shall be capable of heating operation at 0°F dry bulb ambient temperature without additional low ambient controls or an auxiliary heat source.

B. Unit Cabinet:

1. The condensing unit cabinet shall be weatherproof and corrosion resistant. The unit shall be constructed from rust-proofed galvanized steel panels coated with a baked enamel or powder coat finish.

C. Fan:

1. The condensing unit shall consist of one or more direct-drive, vertical discharge propeller fans with blades constructed of thermoplastic polymer material.
2. The condensing unit fan motor shall be variable-speed digitally commutating (DC) type. Fan motor dipswitch shall allow increase of external static pressure setting.
3. The fan motor shall have inherent protection and permanently lubricated bearings and be mounted on vibration isolators.
4. The fan motor shall be provided with a fan guard to prevent contact with moving parts.

D. Condenser Coil:

1. Coils shall be aluminum fins bonded to internally grooved copper tubes. Fins shall have corrosion-resistant coating.
2. The coils shall be pressure tested at the factory.
3. Unit shall be provided with ball-type refrigerant service valves at each refrigerant piping connection.
4. Condensing unit cabinet shall be provided with metal coil guard.

E. Compressor:

1. The scroll compressors shall be variable speed pulse-width inverter (PVM inverter) controlled type, hermetically sealed, which shall vary the compressor speed to follow fluctuations in total cooling and heating load, determined by the suction gas pressure as measured in the condensing unit.

    a. The inverter driven compressor motor in each condensing unit shall be the reluctance DC (digitally commutating) type.

2. Each compressor shall be equipped with a crankcase heater, high pressure safety switch, and internal thermal overload protector.
3. Oil separators shall be provided as part of the compressor module together with an intelligent oil management system.
4. The compressor shall be isolated to avoid the transmission of vibration.
5. In the event of compressor failure the remaining compressors shall continue to operate and provide heating or cooling as required at a proportionally reduced capacity.
6. Multiple compressor operation sequencing: When multiple condenser modules are combined, operation hours of each compressor shall be balanced by means of a duty cycling function, enabling sequential starting of each module at each start/stop cycle, completion of oil return, and completion of defrost, or every 8 hours.
7. Refrigerant shall be R410a.

2.5 REFRIGERANT PIPING

A. All refrigerant lines shall be individually insulated between the condensing units and indoor units. Refer to Section 23 07 19, HVAC Piping Insulation, for insulation requirements.

B. For interconnecting piping between outdoor and indoor equipment, refer to Section 232300, “Refrigerant Piping.”

2.6 SYSTEM CONTROLS

A. General: The controls network shall be capable of supporting remote controllers, schedule timers, system controllers, centralized controllers, an integrated web based interface, graphical user workstation, and system integration to a Building Management Systems via BACnet® and/or LonWorks®.

B. For additional information, Refer Section 23 09 23, Direct Digital Control System for HVAC.

C. Programmable Local Remote Controller: The programmable local remote controller shall be capable of controlling a minimum of 16 indoor units serving a single zone, and of operation with or without a central controller. Controller shall have the following minimum functions:

1. On/Off.
2. Operating mode (cool, heat, auto, dry, and fan, depending on selected system type).
3. Temperature setting.
4. Fan speed setting.
5. Air swing settings.
6. Room temperature and humidity display.
7. Occupancy sensor capable.
8. Schedule operations.
9. Allow/Prohibit local remote control functions.
10. Unit level error code display.
11. Test run.
12. Set temperature range limit.
13. Override of scheduled functions for indoor unit groups.
14. Lock out of On/Off, Mode, Set Temp., Hold-button, and Air Direction.

D. Limited Function Local Remote Controller: The limited function local remote controller shall be capable of controlling a minimum of 16 indoor units serving a single zone. Controller shall have the following minimum functions:

1. On/Off.
2. Operating mode (cool, heat, auto, dry, and fan, depending on selected system type).
3. Temperature setting.
4. Fan speed setting.
5. Air swing settings.
6. Allow/Prohibit local remote control functions.
7. Indoor Unit intake temperature display.
8. Unit level error code display.
9. Test run.
10. Set temperature range limit.

E. Centralized Controller: The controller shall support system configuration, daily/weekly scheduling, monitoring of operation status, error email notification, online maintenance tool and malfunction monitoring. The controller shall have basic operation controls which can be applied to an individual indoor unit, a group of indoor units, or all indoor units. (cool, heat, auto, dry, and fan)The central controller shall be able to enable or disable operation of local remote controllers via a PC. Controller shall have the following minimum functions:

1. On/Off.
2. Operating mode (cool, heat, auto, dry, and fan, depending on selected system type).
3. Temperature setting.

4. Fan speed setting.
5. Air swing settings.
6. Room temperature display.
7. Schedule operations.
8. Morning warm-up/cool-down.
9. Night setback setting.
10. Allow/Prohibit local remote control functions.
11. Unit level error code display.
12. External input/output.
13. PC data back-up.

F. BACnet® and/or LonWorks® Gateway: Gateway to allow connection to Energy Management Systems shall allow changes to the following, as a minimum:

1. On/Off.
2. Temperature setting.
3. Alarm.
4. Operating mode.
5. Fan speed setting.
6. Allow/Prohibit local remote control functions.
7. High/Low limit setback temperature (heat recovery systems only).
8. Air direction/swing settings.

G. Web browser: The controls network shall allow multiple individual users to monitor and control user defined zones via a network PC web browser.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The system shall be installed by a factory-trained and certified contractor, in strict conformance with unit manufacturer's instructions.

B. Install units level and plumb.

C. Install evaporator-fan components as detailed on Drawings.

D. Install indoor heat recovery controllers as detailed on Drawings. Install condensate drain pan piping and run to nearest code-compliant receptacle, or as indicated on Drawings.

E. Install roof- mounted condensing units as detailed on Drawings. Connected condensing units shall allow space for coil cleaning and other required maintenance tasks.

F. Install seismic restraints as required by applicable codes. Refer to Section 230548, "Vibration and Seismic Controls for HVAC Piping and Equipment," for delegated design requirements for seismic restraints.

G. Install and connect refrigerant piping as detailed in unit manufacturers' literature. Install piping to allow access to unit. Install ball-type refrigerant service valves in refrigerant piping at downstream connections of indoor heat recovery units. Refer to Section 232300, "Refrigerant Piping."

H. Insulate all refrigerant piping, including headers, branches, and other components as detailed in unit manufacturers' literature. Refer to Section 230719 "HVAC Piping Insulation."

I. Install air filters at each indoor unit. Install washable, permanent filters at indoor units designed to accept washable, permanent filters. Refer to Drawings schedule, and Section 234100, "Particulate Air Filtration," for filter requirements for ducted, above-ceiling units incorporating mixing boxes.

J. Install cooling coil condensate primary drain pan piping, and run to nearest code-compliant receptacle, or as indicated on Drawings. Install secondary drain pan for units installed over permanent and suspended-tile ceilings. Install secondary drain pan piping and terminate 1/2 inch below ceiling, with escutcheon, in a readily visible location or as shown on Drawings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

C. Duct Connections: Duct installation requirements are specified in Section 233113 "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Section 233300 "Air Duct Accessories."

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units. Provide minimum 4 hours training.

END OF SECTION 238126.13

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to, the following:

1. Examine all other Sections for work related to those other Sections and required to be included as work under this Section.
2. Electrical General Provisions and Requirements for electrical work.
3. Division-1; General Requirements; General Conditions.

B. Organization of the Specifications into Divisions, Sections and Articles, and arrangement of Drawings shall not control the Contractor in dividing the Contract Work among Sub-Contractors or in establishing the extent of work to be performed by any trade.

1.2 GENERAL SUMMARY OF ELECTRICAL WORK

A. The Specifications and Drawings are intended to cover a complete installation of systems. The omission of expressed reference to any item of labor or material for the proper execution of the work in accordance with present practice of the trade shall not relieve the Contractor from providing such additional labor and materials.

B. Refer to the Drawings and Shop Drawings of other trades for additional details, which affect the proper installation of this work. Diagrams and symbols showing electrical connections are diagrammatic only. Wiring diagrams do not necessarily show the exact physical arrangement of the equipment.

C. Before submitting a bid, the Contractor shall become familiar with all features of the Building Drawings and Site Drawings, which may affect the execution of the work. No extra payment will be allowed for failure to obtain this information.

D. If there are omissions or conflicts between the Drawings and Specifications, clarify these points with the District’s Representative before submitting bid and before commencing work.

E. Provide work and material in conformance with the Manufacturer’s published recommendations for respective equipment and systems.

1.3 LOCATIONS OF EQUIPMENT

A. The Drawings indicate diagrammatically the desired locations or arrangements of conduit runs, outlets, equipment, etc., and are to be followed as closely as possible. Proper judgment must be exercised in executing the work so as to secure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structure conditions encountered.

B. Where outlets are placed on a wall, locate symmetrically with respect to each other, furniture, cabinets, and other features or finishes on the wall.

C. In the event changes in the indicated locations or arrangements are necessary, due to developed conditions in the building construction or rearrangement of furnishings or equipment, such changes shall be made without cost to the Contract, providing the change is ordered before the conduit runs, etc., and work directly connected to same is installed and no extra materials are required.

D. Lighting fixtures in mechanical spaces are shown in their approximate location only. Do not install light outlets or fixtures until mechanical piping and ductwork is installed; then install lights in a location to provide best lighting.

E. Coordinate and cooperate in every way with other trades in order to avoid interference and assure a satisfactory job.

F. The location of the existing utilities, building, equipment and conduit shown on the Drawings is approximate. Verify exact locations and routing of existing systems by potholing all trench routes prior to digging the trench. Pothole at least 100 feet ahead of the actual trenching to allow space to alter the new conduit routing to accommodate existing conditions.

G. Underground Detection Services Existing Utility Structures

1. Detection/location services shall be provided utilizing the latest detection equipment available. Services shall be performed by a company regularly engaged in the business of existing Underground Utility Structure Detection for the past 5-years.
2. Prior to excavation and prior to directional boring the following work shall be performed:

    a. Contractor to mark excavating and trenching/directional boring locations and indicate width and depth.
    b. Locate, by way of vertical and horizontal control dimensions, existing subgrade petroleum product pipes, process piping, conduits, sewer, water, gas, storm drain, electrical, telephone, and irrigation lines in the affected areas of Contract Construction Work.
    c. Arrange and meet with the District's Representative to review existing underground conditions.
    d. The proposed route of each excavation shall be continuously surveyed along the entire excavation path using Ground-Penetrating Radar (GPR) operating from the surface grade. The GPR shall detect and map existing underground metal and non-metal, both private and public utility lines, pipes, conduits, conductors, etc. The GPR shall identify the horizontal and vertical location of existing underground conditions located at a depth of up to 3-meters below finish grade and located with a vertical and horizontal accuracy within ±12-inches of actual condition. The Contractor shall add this information to the existing conditions site plan.

3. Exercise extreme caution in directional boring, excavating and trenching on this site to avoid existing underground utilities and structures, and to prevent hazard to personnel and/or damage to existing underground utilities or structures. The Contract Documents, Drawings and Specifications do not include necessary components for construction safety, which is the responsibility of the Contractor.
4. Repair/replace, without additional cost to the Contract, and to the satisfaction of the District any existing work damaged that was identified in the Record Drawings provided; Identified by the District's Representative; Identified by the Underground Detection Services performed; or any existing work damaged as a result of failure to comply with all the Referenced Requirements.
5. The Contractor shall contact Common Ground Alliance (CGA) telephone #811 "Know What's Below-Call Before You Dig" and Underground Service Alert (USA), not less than 72-hours prior to excavation.

Contractor shall not excavate until verification has been received from CGA and USA that existing underground utilities serving the site have been located, identified, and marked.

H. The locations of existing underground utilities, where shown on Drawings, are shown diagrammatically and have not been independently verified by the District, the District's Representative, the Architect/Engineer. The District, the District's Representative, and the District's Architect/Engineer are not responsible for the location of underground utilities or structures, whether or not shown or detailed and installed under this or any other Contracts. The Contractor shall identify each existing utility line prior to excavation and mark the locations on the ground of each existing utility line.

1.4 AIR CONDITIONING, HEATING, PLUMBING EQUIPMENT WIRING

Provide electrical work, materials, and control components required for proper operation of the air conditioning, heating and plumbing systems as indicated on the Electrical, Mechanical, and Plumbing Contract Documents and specified herein.

1.5 PERMITS

Take out and pay for all Required Permits, Inspections and Examinations without additional cost to the District.

1.6 QUALITY ASSURANCE

A. Work and Materials shall be in full accordance with the latest Rules and Regulations as follows. The following publications shall be included in the Contract Documents Requirements. If a conflict occurs between the following publications and any other part of the Contract Documents, the Requirements describing the more restrictive provisions shall become the applicable Contract definition:

1. California Code of Regulations Title 24.
2. California Part 3 "California Electrical Code" CEC, Title 24 and Title 8 "Division of Industrial Safety".
3. California Building Code – CBC.
4. California Fire Code – CFC
5. The National Electrical Code – NEC/NFPA 70.
6. International Building Code – IBC.
7. National Fire Protection Agency – NFPA.
8. National Fire Alarm Code – NFAC/NFPA 72.
9. Underwriter's Laboratory – UL.
10. Other applicable State and Local Government Agencies Laws and Regulations.
11. Electrical Installation Standards National Electrical Contractors Association (NECA) and National Electrical Installation Standards (NEIS):

    a. NECA/NEIS-1: Standard of Practices for Good Workmanship in Electrical Contracting
    b. NECA/NEIS-101: Standard for Installing Steel Conduit (Rigid, IMC, etc.)
    c. NECA/NEIS-104: Recommended Practice for Installing Aluminum Building Wire and Cable
    d. NECA/NEIS-105: Recommended Practice Installing Metal Cable Trays
    e. NECA/NEIS-111: Recommended Practice Installing Nonmetallic Raceways
    f. NECA/NEIS-230: Recommended Practice for Installing Motors
    g. NECA/FOA-301: Standards for Installing and Testing Fiber Optic Cables
    h. NECA/NEIS-305: Standard for Fire Alarm System Job Practice
    i. NECA/NEIS–331: Standards for Installing Building and Service Entrance Grounding
    j. NECA/NEIS-400: Recommended Practice for Installing and Maintaining Switchboards

k. NECA/NEIS-402: Recommended Practice for Installing and Maintaining Motor Control Centers
l. NEIS/NECA and EGSA-404: Recommended Practice for installing Generator Sets
m. NECA/NEIS-405: Recommended Practices for installing and Commissioning Interconnected Generation Systems
n. NECA/NEIS-407: Recommended Practice for Installing Panelboards
o. NECA/NEIS-408: Recommended Practices for Installing Busway
p. NECA/NEIS-409: Recommended Practice for Installing and Maintaining Dry-Type Transformers
q. NEIS/NECA and IESNA-500: Recommended Practice for installing indoor Commercial Lighting Systems
r. NEIS/NECA and IESNA-501: Recommended Practice for Installing Exterior Lighting Systems
s. NEIS and IESNA-502: Recommended Practice for Installing Industrial Lighting Systems
t. NECA/BICSI-568: Standards for Installing Commercial Building Telecommunications System
u. NECA/NEIS-600: Recommended Practice Installing Medium-Voltage Cable

B. All Material and Equipment shall be new and shall be delivered to the site in unbroken packages. All material and equipment shall be listed and labeled by Underwriters Laboratories or other recognized Testing Laboratories, where such listings are available. Comply with all Installation Requirements and restrictions pertaining to such listings.

C. Work and Material shown on the Drawings and in the Specifications are new and included in the Contract unless specifically indicated as existing or N.I.C. (not in Contract).

D. Keep a copy of all applicable Codes and Standards available at the job site at all times for reference while performing work under this Contract. Nothing in Plans or Specifications shall be construed to permit work not conforming to the most stringent of Building Codes.

E. Where a conflict or variation occurs between applicable Codes, Standards and/or the Contract Documents, the provisions of the most restrictive provision shall become the Requirement of the Contract Documents.

1.7 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. General

1. Review of Contractor's submittals is for General Conformance with the design concept of the Project and General Compliance with the information given in the Contract Documents. Any action shown is subject to the Requirements of the Plans and Specifications. Contractor is responsible for quantities; dimensions which shall be confirmed and correlated at the job site; fabrication processes and techniques of construction; coordination of work with that of all other trades and satisfactory performance of their work.
2. The Contractor shall review each submittal in detail for compliance with the Requirements of the Contract Documents prior to submittal. The Contractor shall "Ink Stamp" and sign each item of the submittal with a statement "CERTIFYING THE SUBMITTAL HAS BEEN REVIEWED BY THE CONTRACTOR AND COMPLIES WITH ALL THE REQUIREMENTS OF THE CONTRACT DOCUMENTS". The Contractor shall clearly and specifically identify each individual proposed substitution, substitution of equal or proposed deviation from the Requirements of the Contract Documents with a statement "THIS ITEM IS A SUBSTITUTION".
The burden of research, preparation of calculations and the furnishing of adequate and complete Shop Drawings information to demonstrate the suitability of Contractor’s proposed substitutions and suitability of proposed deviations from the Contract Documents is the responsibility of the Contractor.

3. Departure from the submittal procedure will result in resubmittals and delays. Failure of the Contractor to comply with the Submittal Requirements shall render void any acceptance or any approval of the proposed variation. The Contractor shall then be required to provide the equipment or method without variation from the Contract Documents and without additional cost to the Contract.
4. The Contractor at no additional cost or delays to the Contract shall remove any work, material and correct any deficiencies resulting from deviations from the Requirements of the Contract Documents not approved in advance by the District prior to commencement of work.
5. Shop Drawings submitted by the Contractor, which are not specifically required for submittal by the Contract Documents, or Contractor Shop Drawings previously reviewed and resubmitted without a written resubmittal request to the Contractor, will not be reviewed, considered, or commented on. The respective Shop Drawing submittal/resubmittal will not be returned to the Contractor and will be destroyed without comment or response to the Contractor. The respective submittal shall be considered null and void as being not in compliance with the Requirements of the Contract Documents.
6. Refer to Division-1 for Additional Requirements.

B. Material Lists and Shop Drawings

1. Submit material list and Equipment Manufacturers for review within 35 days of award of Contract. Give name of Manufacturer and where applicable, brand name, type and/or catalog number of each item. Listing of more than one Manufacturer for any one item of equipment, or listing items "as specified", without both make and model or type designation, is not acceptable. Shop Drawings shall not be submitted before review completion of Manufacturers list. The right is reserved to require submission of samples of any material whether or not particularly mentioned herein.
2. After completion of review of the Material and Equipment Manufacturers list, submit Shop Drawings for review. Shop Drawings shall be submitted in completed bound groups of materials (i.e., all lighting fixtures or all switchgear, etc.). The Contractor shall verify dimensions of equipment and be satisfied as to fit and that they comply with all Code Requirements relating to clear working space about electrical equipment prior to submitting Shop Drawings for review. Submittals, which are intended to be reviewed as substitution or departure from the Contract Documents, must be specifically noted as such. The Requirements of the Contract Documents shall prevail regardless of the acceptance of the submittal.
3. Shop Drawings shall include catalog data sheets, instruction manuals, dimensioned plans, elevations, details, wiring diagrams, and descriptive literature of component parts where applicable. Structural calculations and mounting details, signed by a Structural Engineer registered by the State of California, shall be submitted for all equipment weighing over 400-pounds, and shall be in compliance with Title 21 of the California Code of Regulations.
4. Each Shop Drawing item shall be identified with the Specification Section and paragraph numbers, lighting fixture types and Drawing sheet numbers; the specific Shop Drawing is intended to represent. Shop Drawings 11-inches by 17-inches or smaller in size shall be bound in three ring binders. Divider tabs shall be provided in the three ring binders identifying and separating each separate Shop Drawing submittal item. Shop Drawings larger than 11-inches by 17-inches, Shop Drawing pages/sheets submittals shall be sequentially numbered with unique alphanumeric numbering system to facilitate correspondence referencing identification of individual sheets.

5. The time required to review and comment on the Contractor’s submittals will not be less than 14 calendar days, after receipt of the submittals at the office of FBA Engineering. The review of Contractor submittals and return to Contractor of submittals with review comments will occur in a timely manner conditioned upon the Contractor complying with all of the following:

a. The submittals contain complete and accurate information, complying with the Requirements of the Contract Documents.
b. Contractor's submittals are each marked with Contractor's approval "stamp", and with Contractor signatures.
c. The submittals are received in accordance with a written, Shop Drawing submittal schedule for each submittal. The Contractor distributes the schedule not less than 35-calendar days in advance of the Shop Drawing submittals, and the schedule identifies the calendar dates, the Contractor will deliver the various submittals for review.

6. Shop Drawings shall include the Manufacturers projected days for shipment from the factory of completed equipment, after the Contractor releases the equipment for production. It shall be the responsibility of the Contractor to insure that all material and equipment is ordered in time to provide an orderly progression of the work. The Contractor shall notify the District's Representative of any changes in delivery, which would affect the Project completion date.
7. Submittal Identification

a. Each submittal shall be dated: with submittal transmission date; sequentially numbered and titled with submittal contents identification and applicable Specification/Drawing references *(i.e., Submittal dated: 5/12/98 Submittal #4 Contents: Branch circuit panelboards Sheet #E5.1 and Transformers Specification Section 260501 Paragraph 2.11, etc.).*
b. Each resubmittal shall be dated: with original submittal date and resubmittal transmission dates; sequentially numbered with original submittal number and sequential resubmittal revision number and titled with submittal contents identification and applicable Specifications/Drawing references *(i.e., Original Submittal Date: 5/12/98 Resubmittal Date: 10/9/98 Original Submittal #4 resubmittal Revision R2 Contents: Transformer resubmittal Specification Section – 260501 Paragraph 2.11, etc.).*
c. Contractor shall provide a written response narrative with each resubmittal. Describe each response-action, resubmittal addition, change and deletion. Correspond to each response to A/E specific review comment.

C. The Contractor shall be responsible for incidental, direct and indirect costs resulting from the Contractor's substitution of; or changes to; the specified Contract Materials and Work.

D. The Contractor shall pay, upon request by the District's Representative, a fee for the District's Representative time involved in the review of substitution submittals and design changes resulting from the Contractor's requested substitutions. The fee shall be not less than $125.00 per hour but, in no case, less than stated in Division-1, whichever is greater.

E. Maintenance and Operating Manuals

1. The Contractor shall furnish three copies of type-written Maintenance and Operating Manuals for all electrical equipment, fire alarm equipment, sound system equipment, etc., to the District.
2. Instruct the District's Personnel in correct operation of all equipment at completion of Project. Provide the quantity and duration of instruction class as specified; but in no case less than two 4-hour durations separate instruction classes for each individual equipment group furnished as part of the Contract. Instruction classes shall be presented by Manufacturer's Authorized Field Service Engineer at the Project Site. Instruction class size shall be at the District's discretion, not less than one or more than fifteen students shall attend each instruction session. Submit fifteen written outline copies of the proposed instruction class curriculum, 14-days prior to the class-scheduled dates.
3. Maintenance and Operating Manuals shall be bound in three ring, hard-cover, plastic binders with table of contents. Manuals shall be delivered to the District's Representative, with an itemized receipt.

F. Portable or Detachable Parts: The Contractor shall retain in his possession, and shall be responsible for all portable and detachable parts or portions of the installation such as fuses, keys, locks, adapters, locking clips, and inserts until final completion of Contract Work. These parts shall then be delivered to the District's Representative with an itemized receipt.

G. Record Drawings (Additional Requirements)

1. Provide and maintain in good order a complete set of Electrical Contract "Record" prints. Changes to the Contract to be clearly recorded on this set of prints. At the end of the Project, transfer all changes to one set of transparencies to be delivered unfolded to the District's Representative.
2. The actual location and elevation of all buried lines, boxes, monuments, vaults, stub-outs and other provisions for future connections shall be referenced to the building lines or other clearly established base lines and to approved bench marks. If any necessary dimensions are omitted from the Record Drawings, the Contractor shall, at the Contractor's own expense, do all excavation required to expose the buried work and to establish the correct locations.
3. The Contractor shall keep the "Record" prints up to date and current with all work performed.
4. Refer to Division-1 for Additional Requirements.

1.8 CLEANING EQUIPMENT, MATERIALS, PREMISES

All parts of the equipment shall be thoroughly cleaned of dirt, rust, cement, plaster, etc., and all cracks and corners scraped out clean. Surfaces to be painted shall be carefully cleaned of grease and oil spots and left smooth, clean and in proper condition to receive paint finish.

1.9 JOB CONDITIONS - PROTECTION

Protect all work, materials and equipment from damage from any cause whatever and provide adequate and proper storage facilities during the progress of the work. Provide for the safety and good condition of all the work until final acceptance of the work by the District and replace all damaged or defective work, materials, and equipment before requesting final acceptance.

1.10 EXCAVATION, CUTTING, BACKFILL AND PATCHING ADDITIONAL REQUIREMENTS

A. General

1. Perform excavation, cutting, backfill, core drilling, directional boring, and patching of the construction work required for the proper installation of the electrical work.
2. Patching shall be of the same material, thickness, workmanship, and finish as existing and accurately match-surrounding work to the satisfaction of the District's Representative.
3. Prior to penetrating, coring, drilling or cutting existing building elements, concrete and/or masonry, provide imaging equipment examinations of each specific location. The imaging process shall identify existing internal embedded components and locations, including structural elements/anchors, conduit, and piping that are present. Do not penetrate or damage the existing internal embedded elements. Imaging shall employ one of the following, with GPR methodology preferred:

    a. Non-invasive imaging employing high frequency, Ground Penetrating Radar (GPR), single side echo reflection technology.
    b. Non-invasive imaging employing x-ray radiography, through-and-through imaging technology.

B. Excavation Temporary Cover

1. Excavations for Contract Work occurring in streets, vehicular drive areas, parking lots, sidewalks; any paved surface; or any area accessible to the public; provide temporary steel plating and shoring support for the plates, to completely cover the excavations under one or more of the following conditions:

    a. Excavation shall not remain "open" for more than 4-calendar days; provide temporary plating.
    b. Excavation shall not be "open" over weekends (Saturday, Sunday) or Holidays; provide temporary plating.

2. The temporary plating shall be a minimum of 0.75-inch thickness steel, but in no case shall the thickness be less than required to support AASHO-H20 traffic loading.
3. Provide a minimum of two 100% open lane(s) (12-foot lane width) for vehicular traffic at all times during construction, for vehicle access to all areas.

1.11 IDENTIFICATION

A. Equipment Nameplates

1. Panelboards, terminal cabinets, circuit breakers, disconnect switches, starters, relays, time switches, contactors, push-button control stations, and other apparatus used for the operation or control of feeders, circuits, appliances, or equipment shall be properly identified by means of descriptive nameplates or tags permanently attached to the apparatus and wiring.
2. Provide nameplate label on electrical service entrance equipment describing available short circuit information calculated by the Contractor, including:

    a. Calculation date, month-day-year.
    b. Calculate maximum available short circuit fault current.
    c. Description of parameters and changes affecting the Requirements for recalculation of the fault current information.

3. Electrical equipment including switchgear, switchboards, electric panels and control panels, motor control centers, combination motor starters, transformers, disconnects, etc., shall each be labeled by the Manufacturer with “Electric-Arc-Flash” warning signs. The signs shall explain a hazard to Personnel may exist if the equipment is worked on while energized or operated by personnel while energized. The sign shall instruct personnel to wear the correct Protective Equipment/clothing (PPE) when working “Live”, or operating “Live” electrical equipment and circuits.
4. Nameplates shall be engraved laminated phenolic. Shop Drawings with dimensions and format shall be submitted before installation. Attachment to equipment shall be with escutcheon pins, rivets, self-tapping screws or machine screws. Self-adhering or adhesive backed nameplates shall not be used.
5. Provide black-on-white laminated plastic nameplates engraved in minimum ¼-inch high letters to correspond with the designations on the Drawings. Provide other or additional information on nameplates where indicated.

B. Plates: All cover and device plates shall be furnished with engraved or etched designations under any one of the following conditions (minimum character size not less than 0.188 inch. Engraving shall indicate circuits and equipment controlled or connected):

1. More than two devices under a common coverplate.
2. Lock switches.
3. Pilot switches.

4. Switches in locations from which the equipment or circuits controlled cannot be readily seen.
5. Manual motor starting switches.
6. Where so indicated on the Drawings.
7. As required on all control circuit switches, such as heater controls, motor controls, etc.
8. Receptacles other than standard 15 amp 120 volt duplex receptacles; shall indicate circuit voltage, ampere, phase and source circuit number.
9. Where outlets or switches are connected to emergency power circuit; provide panelboard and circuit number engraved on plate.
10. Low voltage and signal system outlets.

C. For equipment and access doors or gates to equipment containing or operating on circuits of more than 100 volts AC or DC nominal. Provide red-on-white laminated warning signs engraved in ½-inch high letters to read: "DANGER - 480 *(or applicable voltage)* VOLTS KEEP OUT AUTHORIZED PERSONNEL ONLY".

D. Wire and Cable Identification

1. Provide identification on individual wire and cable including signal systems, fire alarm, electrical power systems (each individual phase, neutral and ground), empty conduit pull ropes, and controls circuit.
2. Permanent identification shall be provided at each termination location, splice location, pullbox, junction box and equipment enclosure.

    a. Individual wire and cable larger than #6AWG or 0.25-inch diameter, shall be provided with polypropylene identification tag holders, with yellow polypropylene tags interchangeable black alphanumeric characters, character height 0.25 inch. Attach identification tags with plastic “tie” wraps, minimum of two for each tag. As manufactured by Almetek Industries-“EZTAG” Series; or TECH Products - “EVERLAST” series.
    b. Individual wire and cable #6AWG and smaller or smaller than 0.25 inch diameter, shall be provided with water and oil resistant, flexible, self-laminating pressure sensitive machine embossed plastic tags that wrap a minimum of 360 degrees around the wire/cable diameter. The entire tag shall then be covered with a clear flexible waterproof plastic cover wrapped a minimum of 540 degrees around the wire/cable diameter and completely covering the identification. As manufactured by Brady Identification; or 3M; or Panduit.
    c. Each identification tag location shall indicate the following information: circuit number, circuit phase, source termination and destination termination equipment name (or outlet number as applicable).

3. Install permanent identification after installation/pulling of wire/cable is complete, to prevent loss or damage to the identification.

E. Cardholders and cards shall be provided for circuit identification in panelboards. Cardholders shall consist of a metal frame retaining a clear plastic cover permanently attached to the inside of panel door. List of circuits shall be typewritten on card. Circuit description shall include name or number of circuit, area, and connected load.

F. Junction and pull boxes shall have covers stenciled with box number when shown on the Drawings, or circuit numbers according to panel schedule. Data shall be lettered in a conspicuous manner with a color contrasting to finish.

1.12 TESTING

A. The Contractor shall obtain an independent Testing Laboratory, provide all instrumentation and perform tests on the electrical system and equipment as hereinafter described and further directed by the District's Representative. The test shall be performed after the completion of all electrical systems included in the Contract Scope of Work. All tests shall be recorded and documented and submitted to the District's Representative for review.

1. All Equipment and Personnel required for set-up and testing shall be provided by the Contractor.

B. Test for Phase to Ground and Neutral Condition:

1. Open main service disconnects.
2. Isolate the system neutral from ground by removing the neutral disconnects link located in the service switchboard.
3. Close all submain disconnects.
4. Close all branch feeder circuit breakers.
5. Turn all switches to "on" position, unplug all portable equipment from outlet receptacles.
6. Measure the resistance of each phase to ground and phase to neutral. A properly calibrated "megger" type test instrument shall be used. The test voltage shall be a nominal 500 volts.
7. Record all readings after 1-minute duration and document into a complete report.
8. Isolating Grounds: In the event that low resistance ground neutral connections are found in the system, they shall be isolated and located by testing each circuit individually as outlined above. Make proper corrections to restore the resistance values to an acceptable value.

C. Method of obtaining ground resistance shall be in accordance with the latest edition of the James G. Biddle (Plymouth Meeting, Pennsylvania) manual published on this subject.

1. Perform "fall-of-potential" three point tests on the main grounding electrode of system per IEEE Standard No. 81, Section 8.2.1.5. when suitable locations for test rods are not available, a low resistance dead earth or reference ground shall be utilized.
2. Perform the two point method test per IEEE Standard No. 81, Section 8.2.1.1, to determine the ground resistance between the main grounding system and all major electrical equipment frames, system neutral, and/or derived neutral points.

D. The testing, calibrating and setting of all ground and ground fault equipment, circuit breakers, circuit device protection relays, and meters adjustable settings shall be by an independent Testing Laboratory. Set as recommended by the respective Manufacturer and Coordination Study so as to be coordinated with other protection devices within the electrical design. Bound and tabulated copies of the test and settings shall be sent to the District's Representative.

E. Ampere and Voltage Measurements

1. Measure and record ampere and line voltage measurements under full load on all panel feeders, switchboard, and switchgear feeders, motor control centers and motor circuits provided in the Contract. Record measurements at the equipment tested and submit to the District's Representative for review.

2. Ampere voltage readings shall be:

   a. Phase A-B, A-C and B-C.
   b. Phase A-Neutral, B-Neutral and C-Neutral.

3. The ampere and voltage readings shall be not less than 20-minutes duration for each test. Record and submit the measured minimum, maximum and 20-minute average for each ampere and voltage value

and test location. Voltage and ampere measurements shall occur at the connected load end of each respective feeder, not at the source of supply end of each feeder.

4. Test equipment shall be accurate within plus or minus 1%.
5. Branch circuit devices 40 amp or less and motor loads ten horsepower or smaller are excluded from Ampere and Voltage Testing Requirement.
6. If, in the opinion of the District's Representative, the voltages and regulations are not met within acceptable limits, make arrangements with the serving utility for proper electrical service. Retest feeder line voltages, and submit to District's Representative for review, after the Utility Company has completed corrective actions. Reset "voltage taps" on transformers provided or modified as part of the Contract Work, to adjust line voltages to within acceptable values, as directed by the District's Representative.

F. The Contractor shall complete the following work before any electrical equipment is energized.

1. All equipment shall be permanently anchored.
2. All bus connections and conductor/wire connections shall be tightened per Manufacturer's instructions and witnessed by the District's Representative.
3. All ground connections shall be completed and identified. Perform and successfully complete all required megger and ground resistance tests.
4. Feeders shall be connected and identified.
5. The interiors of all electrical enclosures including busbars and wiring terminals shall be cleaned of all loose material and debris, paint, plaster, cleaners or other abrasive's over spray removed and equipment vacuumed clean. The District's Representative shall observe all interiors before covers are installed.
6. All wall, ceiling, and floor work and painting shall be completed within areas containing electrical equipment prior to installation of equipment. The equipment indoor rooms and spaces shall be weather-tight and weather protected from environmental incursions.
7. All doors to electrical equipment rooms shall be provided with locks in order to restrict access to energized equipment.
8. Electrical spaces and rooms shall not be used as storage rooms after power is energized.
9. Outdoor electrical equipment enclosures and housings shall be weather protected.
10. The electrical system time current coordination and Arc-Fault study shall be complete for circuit breakers, ground relays sets, and circuit relay sets, fuses; set-up, tested and calibrated accordingly.

1.13 COMMISSIONING - CX

A. General

1. The Commissioning shall verify the electrical systems for the term of the Contract, by observation; and by calibration; and by testing. The Commissioning shall ensure the electrical systems perform interactively and correctly, according to the Contract and Operational Requirements.

2. Commissioning shall provide startup, testing and documented confirmation of the Contract Constructed Systems, materials and work, functions in compliance within the criteria set forth in the Contract Documents to the satisfaction of the District's needs. The Commissioning Scope shall encompass each system identified as requiring "Commissioning" by the Contract Documents, including but not limited to:

   a. Electrical circuits' protection, short circuit, overcurrent, and ground fault devices.
   b. Electrical circuits monitoring and metering.

c. Light fixtures, lamps and ballasts.
d. Lighting control devices, equipment and lighting control systems.
e. Standby and emergency electric power supply equipment and systems.
f. Fire alarm, equipment, devices and fire alarm systems.
g. Additional systems described in the Contract Documents.

3. Commissioning process shall review all of the Shop Drawing submittals, including:

a. Controls, Operation and Maintenance Requirements.
b. Facility performance testing compliance.
c. Project Contract Requirements compliance.
d. Compliance with basis for design and operational descriptions provided in the Contract.

4. Commissioning shall be the process of ensuring all the systems described in the Contract Documents comply with the Contract Document design; all systems are installed properly; all systems are functional, tested and capable of being operated and maintained to perform within the Contract Requirements and design intent.
5. Functional setup, recalibration, correcting deficiencies, retesting and the associated costs, for system(s) that fail Commissioning, shall be the responsibility of the Contractor. The Contractor shall include all Commissioning costs in the Contract Scope of Work.
6. Complete all Commissioning functions prior to the occupancy of the facility by the District, unless directed otherwise by the District's Representative.
7. Submit six copies of Commissioning Documentation to District's Representative.
8. Commissioning, unless specifically indicated otherwise, shall be performed by Factory-Trained Technician(s) Authorized and Certified by the Manufacturers of the respective equipment/systems. Where specifically indicated, Commissioning shall be performed by Independent Test Lab.

B. Commissioning Procedures

1. Prepare a Commissioning Matrix identifying components and systems included in the Commissioning Scope; the status; actions completed and actions to be completed.
2. Verify Contractor compliance with Contract Document Requirements Manufacturer's recommend-ations and approved Shop Drawings.
3. Perform startup, functional tests, reports, and document results.
4. Evaluate and document the setup parameters, software, operating condition and performance of each system at the time of functional test completion. Document and record each performance parameter and condition, in the Commissioning Report.
5. Schedule testing and prepare descriptions of testing.
6. Describe measures performed to correct deficiencies.
7. Verify that instructions to District's Representatives, Operations and Maintenance Manuals comply with Contract Documents.
8. Prepare warranty matrix identifying the start dates, expiration dates, routine preventative maintenance dates and the District's responsibility for performing preventative maintenance and keeping logs for each maintenance function and warranty claims.
9. Confirm completion of all punch list items that have been acceptably accomplished and a list of what has not been acceptably completed.
10. Describe uncorrected deficiencies accepted by the District.

C. Commissioning Phasing

The Commissioning Phases of work shall include the following activities:

1. SDQ – Shop Drawing Qualification shall verify complete and correct Shop Drawings have been submitted.
2. IQ – The Installation Qualification of Contract Work shall verify systems are correctly and properly installed.
3. OQ – Verify systems interfaces and software are correctly and properly operational.
4. ITM – Verify the Contract Inspection, Testing and Procedures for Maintenance are complete.
5. PQ – Performance Qualification complete the functional performance testing to validate each building system.

1.14 POWER OUTAGES

A. All electrical services in all occupied facilities of the Contract Work are to remain operational during the entire Contract period. Any interruption of the electrical services for the performance of this work shall be at the convenience of the District and performed only after consultation with the District's Representative. Work involving circuit outages shall be only at such a time and of such a duration as approved in writing. Work involving circuit outages for the work required to connect new equipment and disconnect existing equipment shall be performed at the convenience of the District.

B. Contract Work involving outages or disruption of normal function in electrical power systems, telephone/ communication systems, fire alarms, shall be performed during the following time periods. The Contract Work shall be phased to limit outages in the respective systems to the stated periods:

1. 11:30 p.m. Friday to 11:30 p.m. Sunday of the same weekend. Work shall occur on multiple weekend periods if a single weekend is not sufficient time to complete the work.
2. The Contract Work involving outages shall be phased in multiple work time units, to comply with the permitted outage limitations.

C. Work involving system outages to the building fire alarm system shall be performed only after consultation with the District and shall be only at such a time and of such duration as approved in writing. Contractor shall provide continuous "Fire-Watch" during fire alarm system outages and comply with AHJ "Fire-Watch" Requirements.

D. Provide overtime work; double shift work; night time work; Saturday, Sunday, and holiday work to meet outages schedule.

E. Provide temporary electrical power to meet the Requirements of this Article.

F. Any added costs to Contractor due to necessity of complying with this Article shall be included in the Contract Scope of Work.

G. When electrical work involving power disruptions to existing areas is initiated, the work shall proceed on a continuous basis without stopping until electric power is restored to the affected areas.

H. The Contractor shall request in writing to the District's Representative a minimum of 3-weeks in advance, for any proposed electrical outage.

1.15 TEMPORARY ELECTRICAL POWER

A. Provide temporary electrical power if work requiring power outages cannot be completed in time permitted and approved by the District's Representative.

B. Temporary electrical power shall be a standby diesel engine generators. Voltage, frequency, regulation, etc. shall be equal to that of normal utility source. Exhaust system shall have a critical silencing muffler. Generator voltage shall match the existing secondary voltage required at the site. The Contractor shall furnish all necessary cables, switches, etc., to make all required connections to existing panels, feeders, etc. Generator shall be sized to adequately carry the demand load. If record of demand load is not available, size generator to match corresponding transformer, maximum capacity circuit as directed by the District's Representative.

C. After completion of required usage of the temporary generators, prior to completion of the project, the Contractor shall remove the generators. All temporary cables, switches, etc. shall be removed and all permanent equipment left in satisfactory condition.

D. Each generator shall be housed in security type sound attenuated housing to prevent access by unauthorized Personnel. Temporary power cables, connections, etc. shall be protected from unauthorized personnel.

E. The Contractor shall be responsible for complete operation of the generator including personnel, fuel supplies, proper safety precautions, etc. Generator shall not be left unattended while in operation.

F. The Contractor shall provide temporary construction lighting and power as required in areas where work is being performed. Temporary power arrangements, outages, installation, work schedules, etc., shall be submitted in writing 3-weeks prior to requested outage date, and approved by the District's Representative prior to start of work.

1.16 ASBESTOS, POLYCHLORINATED BIPHENYL (PCB) OR HAZARDOUS WASTE:

A. It is understood and agreed that this Contract does not contemplate the handling of asbestos, PCB or any hazardous waste material. If asbestos, PCB or any hazardous waste material is encountered, notify the District's Representative immediately. Do not disturb, handle or attempt to remove.

B. Lighting Fixture Demolition Hazardous Materials

1. The removal of existing lighting fixtures will generate Hazardous Material Waste Disposal Contract Documents.

   a. The existing lighting fixture ballast contains PCB material.
   b. The existing lighting fixture lamps contain mercury.
   c. The existing lighting fixture internal wire insulation may contain asbestos.

2. Remove, handle, store, contain, dispose of and document the hazardous materials resulting from existing lighting fixtures work, as part of the Contract Requirements.

1.17 TIME/CURRENT COORDINATION, SHORT CIRCUIT, ARC-FLASH AND SERIES RATED EQUIPMENT

A. Series Rated Equipment.

1. Circuit protective Devices identified as "Series Rated" or "Current Limiting" (i.e., CLCB - Current Limiting Circuit Breaker; CLF - Current Limiting Fuse, etc.) shall be Series Rated and Tested (UL 489 and CSA5) by the Manufacturer with all equipment and circuit protective devices installed down-stream of the identified series rated or current limiting device.

2. Provide nameplates on all equipment located downstream, including the CLCB and CLF devices, to comply with CEC/NEC paragraphs 110-22 and 240-83 "CAUTION SERIES RATED SYSTEM - NEW DEVICE INSTALLATIONS AND REPLACEMENTS SHALL BE THE SAME MANUFACTURER AND MODELS".

B. Short Circuit, Coordination and Arc-Flash

1. Perform Engineering Analysis and submit engineered settings for each equipment location, fuse and circuit breaker device, showing the correct time and current settings to provide the selective coordination within the limits of the specified equipment. Shall comply with the latest application Standards of IEEE and ANSI. Provide electrical system short circuit worst case bolted-fault analysis, both 3-phase line-to-line and 1-phase line-to-ground calculations as part of the Coordination Analysis recommendations. Provide Electric Arc-Flash calculations as part of the Coordination Analysis recommendations.
2. The information shall be submitted in both tabular form and on time current log-log graph paper, with an Engineering Narrative. Written narrative describing data, assumptions, analysis of results and prioritized recommendations, six copies.
3. The goal is to minimize an unexpected but necessary electrical system outage and personnel exposure to the smallest extent possible within the fault occurrence location, using the specified Contract Equipment. Shall comply with, but not limited to:

    a. IEEE-242, Recommended Practices for Protection and Coordination of Industrial and Commercial Distribution.
    b. IEEE-399, Recommended Practices for Industrial and Commercial Power System Analysis.
    c. IEEE-1584, Guide to Performing Arc-Flash Hazard Calculations.
    d. CEC/NEC

4. Provide permanent warning labels on each equipment location. The labels shall describe Arc-Flash, Short-Circuit and Time/Current Coordination, including safety precautions and protective clothing. Also described actions to be taken if any circuit changes or equipment modifications occur.
5. Shall be submitted with the Shop Drawing submittals for the respective equipment.

1.18 INDEPENDENT TESTING LABORATORY

A. Testing Laboratories Definition

1. The Testing Laboratory shall meet Federal OSHA Criteria for accreditation of Nationally Recognized Testing Laboratories (NRTL) Title 29 Part 1907 and 29 CFR-1910.
2. Membership in the National Electrical Testing Association (NETA) shall also constitute acceptance of meeting said criteria, for testing of electrical systems.

1.19 SPARE FUSES

Provide three spare fuses for each size and type at each location to match the installed fuses where the fuses are provided as part of the Contract. Provide spare fuse holders on inside door of each respective fuse compartment. Provide engraved nameplate on front of fuse access door indicating fuse type/catalog number ampere rating and Manufacturer of fuse.

1.20 EQUIPMENT SEISMIC AND WIND LOAD REQUIREMENTS (ADDITIONAL REQUIREMENTS)

A. Refer to Structural, Architectural, and Soils Report Contract Documents for Additional Requirements.

B. General

1. Equipment supports and anchorage's provided as part of the Contract shall be designed, constructed and installed in accordance with the Earthquake Regulations of the California Building Code (CBC), International Building Code (IBC).
2. Provide equipment anchorage details, coordinated with the equipment mounting provision, prepared, signed and "stamped" with PE Registration in good standing, by a Civil or Structural Engineer Licensed as a Professional Engineer (PE) in the State of California.
3. Mounting recommendations shall be provided by the Manufacturer based upon approved shake-table tests used to verify the seismic design of that type of equipment.
4. The Equipment Manufacturer shall document the details necessary for proper wind-load and seismic mounting, anchorage, and bracing of the equipment for floor, ceiling, and wall/back installation location.
5. Seismic performance shall be based on actual install location of the respective equipment in the building and height above or below grade.
6. The Seismic Requirements are typical for each equipment item exceeding 19-pounds, including but not limited to the following:

    a. Switchgear, switchboards, and motor control equipment
    b. Transformers
    c. Equipment racks and terminal cabinets
    d. Panels
    e. Conduits with floor, ceiling or wall attachment support and conduits with suspension attachments.
    f. Busway, wire way and cable tray
    g. Uninterruptable Power Supplies (UPS)
    h. Inverters
    i. Generators and related equipment
    j. Lighting equipment
    k. Fire alarm equipment

C. Certification

1. Electrical Equipment Manufacturers and Contractor shall provide Special Seismic Certification (SCC) for each specific equipment configuration with shake-table verification, all furnished as part of the Contract Documents Requirements. The SCC shall include the specific installation location characteristics of the respective equipment including as follows:

    a. Ground or floor attachment
    b. Wall attachment
    c. Ceiling attachment
    d. Roof attachment

2. Wind Loading

    Electrical equipment and anchorages shall withstand the wind-load imposed at the install location. Wind Loading Withstand Requirements shall apply to all electrical equipment installed in outdoor locations and to all electrical equipment exposed to the weather. The equipment shall be Tested and Certified by the Manufacturer and Contractor. The Wind-Load Withstand Qualification of the equipment and anchorages shall be verified by the following methods:

    a. Aerodynamic wind tunnel test method.
    b. Analytical calculation method, for oversized equipment too large for wind tunnel test method.

3. The Wind-Load Withstand Rating and the SCC shall comply with the Requirements of the Authority Having Jurisdiction (AHJ), and include the latest revisions, but not limited to the following:

    a. American Society of Civil Engineers; ASCE-7
    b. CBC/IBC; including but not limited to Sections 1702, 1708, 1709, 1708A and 1709A.
    c. California Office of Statewide Health Planning and Development OSHPD; OPA-Preapproval of Anchorage; Code Application Notice CAN 2-1708A.5 and OSP-Special Seismic Certification Approval.
    d. US Department of Homeland Security; FEMA - (installing seismic restraints for electrical equipment).

D. Wall Mounted Electrical Equipment

1. Surface Mounted Equipment

    a. Provide multiple horizontal sections of metal “C” channels for support and attaching wall mounted equipment to walls. Channels shall provide “turned lips” at longitudinal edges to hold “lock-in” fasteners and shall comply with ANSI-1008 and ASTM-A569 latest revision. The channels shall be steel hot dip zinc galvanized. As manufactured by Unistrut or Kindorf.
    b. The “C” channels shall be positioned horizontally within 3-inches of the top and bottom of each, equipment section cabinet and located behind each equipment vertical section. Provide additional intermediate “C” channels at not less than 36-inches on center between the “top” and “bottom” “C” channel positions, located behind each equipment vertical Section.
    c. The “C” channels shall be of sufficient length to provide connection to not less than two vertical structural wall framing elements separated by not less than 16-inches; but in no case shall the “C” channel length be less than the width of the respective Equipment Section.
    d. Attach the “C” channels to the wall structural elements after the wall, finish surface, installation (including painting) is complete.
    e. Attach the “C” channels with fasteners to the building wall framing structural elements as follows: welded to steel framing; bolted to wood framing; cast in place concrete inserts for masonry and concrete construction; drilled “afterset” expansion anchors for existing masonry and concrete construction.
    f. Attach the equipment to the “C” channels with threaded and bolted fasteners to “pre-locate” and lock into the channel “turned lips” and channel walls.

2. Flush mount equipment

    a. Provide anchor attachment of equipment into adjacent wall structural elements.

E. Housekeeping Pad

1. Provide cast-in-place, steel re-enforced concrete raised “housekeeping” pads under all floor standing electrical equipment (except data network equipment racks).
2. Pad sizes

    a. The raised housekeeping pad height shall extend 4-inches above the surrounding finished floor elevation for interior building locations.
    b. The pad shall extend 8-inches below finish grade plus 4-inches above finish grade for outdoor equipment location on grade.

c. The pads shall extend 7-inches past the "footprint" edge of the respective floor standing equipment.

3. Anchor equipment to pads. Anchor pads to the building structural floor. Equipment pad, equipment re-enforcing and equipment anchoring shall comply with Seismic Earthquake Requirements and Wind Load Requirements.
4. Unless shown otherwise on Drawings. The equipment housekeeping pad steel re-enforcing shall consist of two layers of Number 4-size steel-rebar laid horizontally and uniformly spaced 6-inches on center. Position rebar in two directions (90-degrees opposed) and centered inside the concrete house-keeping pad. Horizontal rebar shall extend to within 3-inches of the edge of the concrete pad in all directions. Metal wire "tie-wrap" shall be provided at each rebar crossing.
5. Equipment anchor attachments shall extend through the housekeeping pad and into the structural concrete below the pad a minimum of not less than 2-inches.

1.21 ELECTRICAL WORK CLOSEOUT

A. Prepare the following items and submit to the District's Representative before final acceptance.

1. Two copies of all test results as required under this Section.
2. Two copies of Local and/or State Code Enforcing Authority's Final Inspection Certificates.
3. Copies of Record Drawings as required under the General Conditions, pertinent Division One Sections and Electrical General Provisions.
4. Two copies of all receipts transferring portable or detachable parts to the District's Representative when requested.
5. Notify the District's Representative in writing when installation is complete and that a Final Inspection of this work can be performed. In the event any defect or deficiencies are found during this Final Inspection they shall be corrected to the satisfaction of the District's Representative before final acceptance can be issued.
6. List of spare fuses and locations identified by equipment name and building designation.
7. Prior to energizing, retighten to the proper torque, each circuit conductor lug landing, each bus bar (phases, neutral and ground) and circuit protection device threaded connections in all switchboards, switchgear, motor control centers, transformers, busways, disconnect switches, motor starters, motor terminals and panelboards, after the equipment is installed/connected and prior to energizing the equipment. The torque values shall comply with Manufacturer's recommendations.

B. Electrical Power Single Line Diagrams – SLD

1. Provide single line diagrams showing the Contract Document Work complete electrical power system (normal and emergency). SLD shall show inter-connection circuits, electrical equipment, panels, and circuit protection devices, nominal 50% (½-size) approximately 18-inches by 24-inches. Show installed voltages and electrical capacity sizes.
2. SLD shall be mounted in metal (picture frame) rigid enclosure frame with rigid-backing (backer-board) and clear/transparent front, for hanging on wall. Provide clear transparent cover over SLD inside the frame.
3. Provide a wall-hung (±48-inches) SLD in each "main" and "sub" electrical equipment room. If wall space is limited, alternatively securely attach SLD frame to room door facing into the respective electrical room.

END OF SECTION 260500
040119/212227

[BLANK PAGE]

SECTION 260501 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other Sections for work related to those other Sections and required to be included as work under this Section.
2. General Provisions and Requirements for electrical work.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Submit product data sheets for all outlet boxes, floor boxes, wiring devices, device plates, relays, contactors, time switches, and disconnects fuses.

B. Submit Detailed Shop Drawings including Dimensioned Plans, elevations, details, schematic and point-to-point wiring diagrams and descriptive literature for all component parts for transformers, relays, time clocks, and photocells.

C. Submit Transformer Test Reports.

D. Submit Material List for Outlet Boxes.

PART 2 - PRODUCTS

2.1 OUTLET AND JUNCTION BOXES

A. General:

1. Flush or concealed outlet boxes and junction boxes.

a. Non-masonry and/or non-concrete locations provide pressed steel boxes. Steel thickness not less than 0.062-inch, hot-dip galvanized. Knockout (KO) type with conduit entrances and quantities size to match conduits shown connecting to respective junction box and outlet box.
b. UL-514 listed and labeled.
c. Minimum required box depth is exclusive of extension-ring depth.
d. Provide all boxes with matching cover plates. Cover plates shall be gasketed water-tight in wet and outdoor locations.
e. Boxes installed in masonry or concrete shall be UL "concrete-tight" approved for installation in concrete, and shall allow the placing of conduit without displacing reinforcing bars.

2. Provide outlet boxes of proper Code size for the number of wiring devices, connecting conduits, and conductors/cables or conduits passing through or terminating therein. In no case shall outlet box be less than 4.0-inches square by 2.125-inches deep. Unless specified elsewhere or noted otherwise on the Drawings, 2.5-inches minimum depth for box width's exceeding 2-gang.
3. Increase the minimum outlet box size to 4.69-inches square by not less than 2.125-inches deep, where one or more of the following conditions occurs:

    a. More than two conduits connect to the outlet box.
    b. Circuit "Homerun" or Conduit "Homerun" connects to outlet box.

4. Signal, Communication and Low Voltage Outlet Boxes:

    a. Individual or duplex audio/visual, telephone, computer or data outlets: 4.69-inches square by 2.125-inches deep minimum with single gang wide extension ring.
    b. Combination AV/signal/telephone/data or computer outlets: 4.69-inches square by 2.125-inches deep minimum with 2-gang wide extension ring.

5. Junction boxes shall be sized to comply with the following:

    a. Code Requirements size based on the conduit quantities, conduit sizes and wire-fill connected to the junction box.
    b. Junction box minimum size shall not be less than 4.69-inches square by 2.5-inches deep, but not less than size indicated on the Drawings or required by Code.

6. Provide extension rings on flush outlet boxes and flush junction boxes, to finish face of extension ring flush to (within ±0.63-inches) of finished building surfaces. Extension ring shall match outlet box materials/construction and contain "attachment mounting-tabs" for wiring devices. Extension rings shall be "screw-attached" to respective box and maintain "ground" bonding continuity.
7. Outlet boxes installed in outdoor locations, or in wet locations, or in concrete/masonry, shall be cast-iron or cast-bronze, with threaded conduit hubs. UL rated for wet locations.

    a. Aluminum boxes shall NOT be in contact with concrete or masonry. Die-cast aluminum or cast aluminum water-tight electrical outlet boxes with threaded hubs may be provided as an alternate to cast-iron or cast-bronze outlet boxes, only where one or more of the following conditions occur:

        1) Outdoor locations above finish grade.
        2) Indoor wet locations surface or flush in walls or ceilings.
        3) Not in contact with concrete or masonry.

8. Provide fixture-supporting device in outlet boxes for surface mounted fixtures as required.
9. Provide solid gang boxes for three or more devices, typical for line and low voltage switches, receptacles, low voltage/signal outlets, etc. for mounting devices behind a common device plate.
10. Provide isolation barriers in outlet boxes:

    a. Between line voltage and low voltage devices.
    b. Where more than one device is installed in an outlet box, between and separating each device.
    c. Between 277-volt and 120-volt devices.
    d. Between devices connected to emergency and non-emergency circuits of all voltages.

11. Outlet boxes installed penetrating into fire rated walls, fire rated floors, fire rated ceilings and all fire rated construction. The outlet boxes shall be UL listed, classified and labeled, for fire rated and temperature rated penetration of the respective fire rated surface and fire rated construction. The outlet box fire rating and temperature rating shall equal or exceed the fire/temperature rating of the surface/ construction being penetrated. Provide UL listed and labeled supplemental fire and temperature protection to maintain ratings:

    a. Wall and ceiling penetrations, supplemental tumescent fire wrap (external or internal of outlet box).
    b. Floors provide subfloor supplemental fireproofing below floor box.

12. Outlet boxes installed in floors. The floor outlet boxes shall be UL listed and labeled for Scrub Water Exclusion Requirements, including but not limited to tiles, carpeting and exposed wood and concrete floor fishes.
13. Outdoor flush in wall device outlet boxes:

    a. Flush in wall outlet box with corrosion resistant gasketed water tight, hinged, key locking cast metal, self-closing cover. Tamper resistant and vandal resistant.
    b. UL-listed and labeled for installation in masonry, cast-in-place concrete, hollow-framed walls and wet locations.
    c. Flush cast-iron or cast-bronze or brass, device back-box, nominal 4.68-inch square by 2.25-inch deep.
    d. Internal metal adapter plate for wiring device types, in the box as indicated on the Drawings.
    e. As manufactured by Legrand/Pass and Seymour #4600 Series; or C.W. Cole #310 Series.

14. PVC Coating

    a. Metal outlet and junction boxes installed in outdoor or exposed non-weather protected locations shall be PVC coated.
    b. PVC coating shall be factory applied, to comply with NEMA-RN1 and 5-19.
    c. The adhesion of the PVC coating to the metal box shall exceed the strength of the coating itself, based on 0.5-inch "strip-pull" test.
    d. Uniform coating thickness shall be continuous without "breaks" or "pinholes" and shall not be less than the following:

        1) Box exterior surfaces, 40-millimeter coating thickness.
        2) Box interior surfaces, 10-millimeter coating thickness.

15. Refer to Architectural and Structural Contract Documents and Details for Additional Box and Install Requirements.

B. Surface Outlet Boxes

1. Surface mounted outlet boxes, cast iron Type FS or FD, with threaded hubs as required. Box interior dimensions and interior volume capacity not less than required for “press steel boxes”, and “sheet steel boxes”. Provide plugs in all unused openings. Provide weatherproof gaskets for all exterior boxes.

C. Floor Boxes

1. General:

a. Outlet boxes installed in floors. The floor outlet boxes shall be UL listed and labeled for Scrub Water Exclusion Requirements, including but not limited to floor tiles, carpeting and exposed wood and concrete floor fishes.
b. Electrical power receptacles in a floor box; shall be industrial grade wet location heavy-duty, high-abuse rated devices, tamper resistant. Grounding type, 125 volts, 60Hz AC, 20-amp, NEMA 5-20R (duplex), or other NEMA configurations noted on the Drawings. Standard length receptacle mounting strap as required by the Manufacturer of floor box being furnished.
c. Tested, listed and labeled to comply with UL-514A and/or UL514C.

2. Poke-Thru floor boxes for “After-Set” Floor Outlets.

a. Through floor wiring for power and communication shall be UL listed with a fire and temperature rating of not less than 2-hours. The units shall include an internally divided floor fitting; a divided through-floor conduit/ raceway, and a divided under floor junction “split-box” not less than 4.7-inches by 4.7-inches by 2.125-inches in size. Junction box shall be installed concealed in ceiling space of the floor below. The length of the floor “through-raceway” shall match the thickness of the finish floor and as recommended by the Manufacturer. Unit shall be self-supporting without the attachment of an above floor fitting. Internal isolation barriers between high potential and low potential circuits and sections. The integral fire barrier shall incorporate a cold smoke barrier to prevent the passage of smoke when heat is not present.
b. Poke-Thru Floor boxes shall contain dual services for high potential and low potential devices and circuits.
c. Non-Pedestal Poke-Thru flush in floor type; (internal divided high potential and low potential sections) die cast, flush with finish floor, metal cover flip-open, locking, hinged access covers. Open-close die cast aluminum port-covers for plug-in portable cable connections. ADA compliant, wide trim matching flange.

1) Two 20-amp, 120 volt, 60Hz, AC, grounding duplex convenience receptacles for high potential power connections.
2) Four RJ-45 keystone, snap-in retainers for low potential plug-in signal connections. The Contractor shall provide the type of outlet(s) at each poke-thru location as required by the Low Voltage-Signal Contract Documents.
3) Cover shall close and lock after portable plug-in cables have been inserted into respective connections, under the cover.
4) UL wet mop, scrub water rated for carpeted and non-carpeted floors.

d. Die cast aluminum cover, nominal 8-inch diameter metal housing flush in “core-hole”, outlet metal body size.
e. Flush with floor or pedestal type as indicated on Drawings. As manufactured by Wire-mold/ Legrand# Evolution Poke-Thru 8AT Series, Smoke and Fire Rated Poke-Through fittings; no known equal.

4. Floor Boxes for Flush Floor Outlets (non-pedestal), recessed concealed inside outlet box, plug-in receptacles.

a. Provide cast-in-floor with concrete pour pan, rated for on grade to prevent direct earth contact, cast-in-place concrete floors on-grade and above-grade; adjustable "leveling-feet" for box.

b. UL wet mop, scrub water rated for carpeted and non-carpeted floors. UL-File E171211 installation fire rating and/or UL-Fire Resistance Classified.
c. Floor boxes shall contain dual services:

1) High potential with not less than two 120 volt 60Hz AC 20-amp grounding duplex convenience receptacles.
2) Low potential for low voltage system outlets and signal circuits with up to and including eight RJ-45 plug-in keystone snap-in retainer receptacles. The Contractor shall provide the type of outlet(s) at each poke-thru location as required by the low voltage-signal Contract Documents.
3) Internal isolating barrier between high and low potential circuits and sections of box.
4) Also refer to Drawings for additional outlet Requirements.

d. Conduit knockouts in bottom of box and in each side walls of box. Not less than one 1.25-inch and one 0.75-inch knockouts for both low potential and high potential conduits connections on each opposing box sides. Include the same configuration of knockouts on the bottom of the box, for high potential section and low potential sections.
e. Floor box cover:

1) Flush tamper resistant "lock-down" removable main cover. Independent hinged "flip-out" port in the removable cover, to allow main box cover to be in a fully closed position with "plug-in" cords connected into box when the lock-down cover is closed. Main cover "lock-down" to prevent non-authorized access into box interior.
2) Brass, removable recessed main cover, rated for carpet, or tile for floor finish, brass overlapping trim cover finish. Cover recess depth 0.25-inch, 0.5-inch or 0.75-inch as required to match respective floor covering thickness and type. ADA compliant, wide trim matching flange.

f. Floor box with metal body, nominal box size 10-inches by 12-inches by depth to match floor, but not less than 3.0-inches deep box.
g. Floor box as manufactured by FSR #FL-500P Series; no known equal.

2.2 PULL BOXES

A. General

1. Sizes as indicated on the Drawings and in no case of less size or material thickness than required by the Governing Code and AHJ.
2. Exercise care in locating pull boxes to avoid installation in drain water flow areas and to clear existing condition interferences.
3. UL listed and labeled for electrical circuits.

B. General Purpose Sheet Metal Pullbox

1. General purpose sheet steel pull boxes: Install only in dry protected locations with removable screw attached covers. Manufacturer's standard rust proofing and baked enamel finishes.
2. Weatherproof sheet steel pull boxes: Fabricate of Code gauge steel. All surfaces interior and exterior hot-dip galvanized steel. Gasketed weathertight cover of same material.

C. Concrete Pull Boxes and Hand-Holes for Electrical

1. AASHTO H-20 traffic loading rated box and cover, pre-cast concrete, steel reinforced pull boxes and hand-holes. Provide complete with pulling irons, hot-dip galvanized metal traffic cover with hot-dip galvanized metal cover frame, pull-box concrete base with sump. Four cable full height wall racks with porcelain cable support blocks.
2. Boxes shall be “Intercept” type with Multiple Box Sections. Extension cable-intercepts at both ends of box. Refer to Drawings for box size.
3. Covers shall be flush bolt down. Covers weighing more than 40-pounds shall be split cover type “Torsion-Sping” assist, hinged open-close.
4. Box covers shall comply with Federal ADA, UL, State and Local AHJ for slip resistance. Provide cast-or-bead weld on cover of pull box to indicate services within pull box (i.e., "480/277-VOLT, 3-PHASE, 4-WIRE ELECTRICAL" OR “SIGNAL/TEL/P.A./CLOCK/FIRE ALARM" etc.).
5. Shall be set on a machine-compacted pea gravel base 12-inches thick with gravel base extend 6-inches beyond box base on all sides. Provide a 0.75-inch by 10-feet copper clad ground rod through the box bottom with 9-inch projection into box, for grounding all metal parts and frames with continuous #10 AWG copper bond wire.
6. Seal all box joints and seal box between cover and frame with a mastic compound similar to Parmagum or Dukseal. After cables have been pulled, connected, tested and inspected, seal box cover and bolt-close cover.
7. As manufactured by Jensen Precast; or Oldcastle Precast.

2.3 SWITCHES, WIRING DEVICES

A. General

1. Provide wiring device circuit switches totally enclosed, electrical insulating Bakelite or electrical insulating composition base, manual operator type with 277 volt 60Hz AC rating for full capacity contacts rated for incandescent lamp loads, fluorescent lamp loads and motor loads. Switch mounting-ears for screw attachment to outlet box. Switches shall be UL listed and labeled; conform to NEMA-WD1 and WD6.
2. Switch controlling (on-off) rated for all lighting loads and all non-lighting loads; switch ratings shall be 20-amp; unless indicated otherwise on Drawings.
3. Color as selected by Owner’s Representative. Switches and wiring devices controlling circuits connected to emergency power shall be red.
4. All switches shall be of the same Manufacturer.
5. Where switches are mounted in multiple gang assembly and are operating at 277 volts and/or 277 volts and 120 volts or emergency/non-emergency and mounted in same outlet box, there shall be an insulating barrier installed between each switch.
6. Devices shall additionally be listed and labeled as UL-All Weather-Resistant wet-location for the following install locations:

    a. Devices indicated on Drawings as Weather-Proof (W.P.).
    b. Devices installed in outdoor locations
    c. Installed in classified wet or damp area locations both indoor and outdoor.

7. Wiring devices shall be listed and labeled for connection of both “solid” and “stranded” copper circuit conductors.
8. Switches with ampere and voltage ratings different than described herein. The different rated switches shall have the same characteristics and performance as the respective described switches, except for differing ampere and voltage characteristics.

B. Switches Heavy Duty (Toggle – Type)

1. Single Pole Switches – 20 amp at 277V

Manufacturer	Toggle Type	Lock Type
Hubbell	#HBL1221	#HBL1221-L
Legrand/P&S	#20AC1	#20AC1-L
Leviton	#1221	#1221-L
Cooper-Arrow/Hart	#AH1221	#AH1221-L

2. Double Pole Switch – 20 amp at 277V

Manufacturer	Toggle Type	Lock Type
Hubbell	#HBL1222	#HBL1222-L
Legrand/P&S	#20AC2	#20AC2-L
Leviton	#1222	#1222-L
Cooper-Arrow/Hart	#AH1222	#AH1222-L

3. Three-Way Switches – 20 amp at 277V

Manufacturer	Toggle Type	Lock Type
Hubbell	#HBL1223	#HBL1223
Legrand/P&S	#20AC3	#20AC3-L
Leviton	#1223	#1223-L
Cooper-Arrow/Hart	#AH1223	#AH1223-L

4. Four-Way Switches – 20 amp at 277V

Manufacturer	Toggle Type	Lock Type
Hubbell	#HBL1224	#HBL1224-L
Legrand/P&S	#20AC4	#20AC4-L
Leviton	#1224	#1224-L
Cooper-Arrow/Hart	#AH1224	#AH1224-L

5. Momentary Contact Switches – 20 amp at 277V

Manufacturer	3-Position Regular	3-Position Lock
Hubbell	#HBL1557	#HBL1557-L
Legrand/P&S	#1251	#1251-L
Leviton	#1251	#1251-L
Cooper-Arrow/Hart	#AH (extra)	#AH (extra)

6. Maintained Contact Switches (Double Throw, Center Off) – 20 amp at 277V

	Toggle Type		Lock Type	
Manufacturer	1-Pole	2-Pole	1-Pole	2-Pole
Legrand/P&S	#1225	#1226	#12250L	#1226-L
Hubbell	#HBL1385	#HBL1386-L	#HBL1385-L	#HBLM1386-L
Leviton	#1385	#1386		
Cooper-Arrow/Hart	#AH(extra)	#AH (extra)	#AH (extra)	#AH (extra)

7. Pilot lights used in conjunction with circuit switches shall be LED type with red jewel.

C. Switches

1. 120 volt 60Hz AC, rated 15 amp for lighting loads and rated 20 amp for non-lighting loads, unless indicated otherwise on Drawings.

2. Single Pole Switches

Manufacturer	Rocker Type
Legrand/P&S	#TM870
Hubbell	#RSD115
Leviton	#5621-2
Cooper-Arrow/Hart	#7501

3. Double Pole Switch

Manufacturer	Rocker Type
Legrand/P&S	
Hubbell	#RSD215
Leviton	#5622-2
Cooper-Arrow/Hart	#7502 (extra)

4. Three-Way Switches

Manufacturer	Rocker Type
Legrand/P&S	#TM873
Hubbell	#RSD315
Leviton	#5623-2
Cooper-Arrow/Hart	#7503

5. Four-Way Switches

Manufacturer	Rocker Type
Legrand/P&S	#TM874
Hubbell	#RSD415
Leviton	#5624-2
Cooper-Arrow/Hart	#7504

6. Momentary Contact Switches

Manufacturer	3-Position Regular
Legrand/P&S	#TM870 (extra)
Hubbell	#RSD (extra)
Leviton	#5624-2
Cooper-Arrow/Hart	#7521

7. Maintained Contact Switches (Double Throw, Center Off).

	Rocker Type	
Manufacturer	1-Pole	2-Pole
Leviton	#5685-2	#5686-2

8. Pilot lights used in conjunction with circuit switches shall be LED type with red jewel.

D. Weather-Proof (W.P.) Switches

1. Outdoor switches provide heavy-duty, tamper resistant gasketed weather proof metal, hinged door cover for each switch.
2. Cover door shall be key locking-type or padlock-type.

E. Other Switches, Receptacles, Devices, and Outlets

1. Special devices outlets and outlet locations shall be as indicated on the Drawings. Modify device and outlet characteristics to accommodate the actual install location conditions for each outlet.

2.4 ELECTRIC RECEPTACLE WIRING DEVICES

A. General

1. All receptacle wiring devices in flush type outlet boxes shall be installed with a bonding jumper to connect the box to the receptacle ground terminal. Grounding through the receptacle mounting straps is not acceptable. The bonding jumper shall be sized in accordance with the branch circuit protective device as tabulated herein under "Grounding". Bonding jumper shall be attached at each outlet to the back of the box using drilled and tapped holes and washer head screws 6-32 or larger (except isolated ground receptacles). For receptacles in surface mounted outlet boxes direct metal-to-metal contact between receptacle mounting strap (if it is connected to the grounding contacts) and outlet box may be used. Receptacle mounting-ears for screw attachment to outlet box. Receptacle shall be UL listed and labeled; conform to NEMA-WD1 and WD6.
2. All receptacles shall be a product of the same Manufacturer.
3. Receptacle color as selected by Owner's Representative. Receptacles connected to emergency power circuits shall be red.
4. Tamper Resistant Receptacle

    a. Devices shall additionally be listed and labeled as tamper resistant, provide tamper resistant receptacles in buildings containing: dormitories, guestrooms, condominiums, housing/ residences, apartments, dwellings, hotels/motels, classrooms, secondary schools K through 12th grade, child-care/day-care/kindergarten, hospital pediatric-care units and other locations required by AHJ.
    b. The electrical receptacles shall be rated "Tamper-Resistant-Receptacle" (TR), UL-TR (RTRT). Spring loaded shutters shall automatically open-close (unblock-block) the receptacle slots, when the plug-in (cap) insertion and removal occurs.
    c. Typical for 15-amp and 20-amp receptacles. Modify Manufacturer's catalog number description to include tamper resistant receptacle function.

5. Wiring devices shall be listed and labeled for connection of both "solid" and "stranded" copper circuit conductors.
6. Duplex convenience receptacles and 120-volt single phase branch circuits.

    a. Duplex (convenience) receptacle, wiring device with two single receptacles with the same electrical rating, integrated into a single assembly by the Manufacturer.
    b. 20-amp branch circuits with a single duplex convenience receptacle connection on each circuit, receptacles shall be rated for 20-amp.
    c. 15-amp and 20-amp branch circuits with two or more duplex convenience receptacle connections each circuit, receptacle shall be rated 15-amp or 20-amp.

7. Devices shall additionally be listed and labeled as UL-All Weather-Resistant, provide weather resistant receptacles for the following install locations. Modify Manufacturer's catalog number descriptions, shall include all-weather-resistant UL listing and labeling:

    a. Devices indicated on Drawings as Weather-Proof (W.P.).
    b. Devices installed in outdoor locations.
    c. Devices installed in classified as damp or wet locations both indoor and outdoor.
    d. All GFCI (ground-fault) receptacles all locations.

8. Receptacles with ampere and voltage ratings different than described for duplex convenience receptacles. The different rated receptacles shall have the same characteristics and performance as the

respective duplex convenience receptacles, except for differing ampere and voltage characteristics. Refer to "Floor Boxes" for additional receptacle Requirements".

9. Receptacles shall be GFCI type for the following locations:

   a. located within 84-inches of a sink or hosebib shall be GFCI receptacles.
   b. Devices installed in outdoor locations.
   c. Devices installed in classified as damp or wet locations both indoor and outdoor.
   d. Devices indicated on Drawings as GFCI or Weather-Proof (W.P.).

10. "Split-wire" duplex convenience receptacles. Each split-wire receptacle plug connects on independent common circuit. Provide nameplate or graphic on face of receptacle describing the receptacle function and control source. Comply with California Title-24 and ASHRAE-90.1, latest revisions.

B. Duplex convenience receptacles.

1. Shall be grounding type, 120 volt and shall have two current carrying contacts and one grounding contact which are internally connected to the frame. Outlet shall accommodate standard parallel blade cap and shall be side wired. Receptacles shall be tamper resistant–TR, UL-TR.
2. GFCI receptacles shall be all Weather-Resistant and wet location rated. Duplex, rated 120 volt 60Hz AC, 20 amp, unless indicated otherwise on Drawings.
3. Heavy Duty Industrial Grade

Manufacturer	NEMA 5-15R	NEMA 5-20R	NEMA 5-20R-GFCI
Legrand/P&S	#5262	#5362	#2095HG
Leviton	#5262	#5362	#W7899
Hubbell	#CR5252	#5362	#GFR8300
Cooper-Arrow/Hart	#AH5262	#AH5362	#WRVGF20

C. Isolated Ground Receptacles-IGR

1. The receptacle insulation barrier shall isolate the receptacle ground contact system from ground. Connect the ground plug contact to a separate dedicated insulated ground-bonding conductor. The receptacle ground plug contact shall not be grounded to the raceway or outlet box. Isolated ground duplex convenience receptacle 20-amp minimum, with two current carrying contacts and one grounding contact, or as noted on the Drawings.
2. High-abuse, heavy-duty industrial grade, NEMA 5-20R, duplex convenience receptacles.
3. Identify receptacle with an orange triangle on the receptacle face and orange receptacle body. Red body for receptacles connected to emergency power.

Manufacturer	NEMA 5-20R
Legrand/P&S	...#IG6300
Leviton	……#5362IG
Hubbell	……#CR5352IG
Cooper-Arrow/Hart	#IG5362

D. Weather Proof (W.P.) Receptacle

1. Outdoor receptacles shall be duplex convenience GFCI type rated 20-amp 120 Volt 60Hz AC weather-proof, GFCI, unless indicated otherwise on Drawings. Test-reset buttons and visual pilot.
2. GFCI receptacles shall be wet location and Weather-Resistant rated weatherproof, gasketed, key locking tamper resistant, wet location.
3. Outdoor, flush mount outlet with hinged, key-locking, weather-proof cover (CEC/NEC – 406.8 compliant). As manufactured by Pass and Seymour/Legrand #4600 Series; or C.W. Cole #310 Series.

4. On exposed conduit runs, provide weatherproof ground fault circuit interrupter type GFCI receptacles installed in "FS" condulet water tight cast metal body, with weather-proof spring door type covers, gasket water tight. Door shall be key locking-type or padlock-type.

G. Other Switches, Receptacles, Devices, and Outlets.

Special devices, outlets and outlet locations shall be as indicated on the Drawings. Modify device and outlet characteristics to accommodate the actual install location conditions for each outlet.

2.5 PLATES

A. Metal Cover Plates for Devices

1. Provide cover plates for every line voltage and low voltage switch, receptacle, telephone, computer, television, signal and other device outlets.

   a. All line voltage circuit plates shall be metal, 0.040-inch stainless steel Type 302 alloy, composed of 18% chromium and 8% nickel.
   b. Plates for low voltage signal systems may be metal or non-metal. Non-metal plates shall be high-abuse, hard-service and high-impact resistant.

2. Plates shall be as manufactured by P&S; or Hubbell; or Leviton; or General Electric.

2.6 VANDAL-PROOF FASTENINGS

Provide approved vandal-proof type screws, bolts, nuts where exposed to sight throughout the Project. Screws for such items as switch plates, receptacle plates, fixtures, communications equipment, fire alarm, blank covers, wall and ceiling plates to be spanner head stainless steel, tamperproof type. Provide Owner with six screwdrivers for this type.

2.7 STRUCTURAL AND MISCELLANEOUS STEEL

Structural and miscellaneous steel used in connection with electrical work and located out-of-doors or in damp locations, shall be hot-dip galvanized unless otherwise specified. Included are underground pull box covers and similar electrical items. Galvanizing averages 2.0 ounce per square foot and conforms to ASTM A123.

2.8 FLASHING ASSEMBLIES

A. General

1. Flashing shall be compatible with the material being penetrated and with the pipe passing through the flashing. Coordinate with and comply with Manufacturer's recommendations, for both the flashing and the material being penetrated.
2. Provide lead metal flashing assemblies at all roof penetrations, unless recommended otherwise by Manufacturer.
3. Seal the joint between the flashing and pipe passing through the flashing with waterproofing compound.
4. Lead flashing for roof penetrations, as manufactured by: Santa Rosa Lead Products; or Semco; or Flashco.

B. Storm Collars

1. In addition to penetration flashing, provide a storm-collar counter-flashing for each roof penetration flashing. Shall attach to the structure of the penetration and form a water-tight "umbrella" counter flashing over the roof penetration flashing.
2. As manufactured by: STD-Storm collars; or ASI-Storm collars.

2.9 RELAYS, CONTACTORS, AND TIMESWITCHES

A. Individual Control Relays (HVAC Plumbing of the Control Functions)

1. Individual control relays shall have convertible contacts rated a minimum of 10 amp, 600 volts regardless of usage voltage. Coil voltage, number and type of contacts shall be verified and supplied to suit the specific usage as shown in the wiring diagrams and/or schedules on the Electrical and Mechanical Drawings. Coil control circuit shall be independently fused, sized to protect coil. Relays shall be installed on prefabricated mounting strips. Each relay shall have a surge suppressor to limit coil transient voltages. Furnished in the NEMA Type I enclosure unless indicated otherwise.
2. The following relays are approved:

Manufacturer	Type
Cooper-Arrow/Hart	IMP
General Electric	Class CR 2811
Square D Co.	Class 8501, Type A
Westinghouse	Bul. 16-321, Type NH
Allen Bradley	Approved Equal

B. Contactors and/or Relays

1. Contactors and/or relays for control of lighting shall be 600 volt AC, electrically operated, and mechanically held units, open type for panel mounting with number of poles and of size as indicated on the Drawings. Provide auxiliary control relay for operation of each contactor and/or relay with a 2-wire control circuit.
2. Contactors and/or relays shall be mounted in panelboards in barriered section under separate hinged lockable doors or in contactor and/or relay cabinets as called for on the Drawings. Contactors and/or relays shall be installed on Lord sound absorbing rubber mounts.
3. Contactors and/or relays shall be Automatic Switch Co. Bulletin #920 Series for 2-pole and 3-pole, Automatic Switch Co. Bulletin 917 Series with poles as indicated on Drawings. Coil control circuit shall be independently fused, sized to protect coil.
4. Contactors and/or relays shall be equipped with a switch, in the proper configuration, to disconnect the control circuit controlling the coil of the respective device. Control circuit disconnect switch shall be labeled showing function of device.

C. Time-Switches

1. All timeswitches shall have synchronous motor drive for operation on 120 or 277 volts, 60Hz, AC and shall be furnished with a 10-hour, spring-driven, reserve-power motor. Contacts shall be rated 40-amp per pole.

    a. Exterior lighting timeswitches for control of individual circuits or electrically operated relays shall have astronomic dial and shall be Tork 7000ZL Series or approved equal by Paragon or Intermatic.

b. Interior lighting timeswitches for control of individual circuits or electrically operated relays shall be Tork 7000 Series or approved equal by Paragon or Intermatic.
c. Timeswitches for control of air conditioning or plumbing equipment shall have seven day dial and shall be Tork WL Series or approved equal by Paragon or Intermatic.

2. All timeswitches shall be mounted in separate section in top of panelboards under separate lockable door unless otherwise indicated on Drawings. Clear opening for timeswitch shall be a minimum of 12-inches by 12-inches.

D. Contactors and/or Relays/Timeswitch Cabinet

1. Contactors, relays, and/or timeswitches not indicated to be mounted in electrical panels shall be mounted in a cabinet, size as required, with hinged lockable door keyed same as panelboards. Construction of cabinet shall be similar to terminal cabinets.
2. Each contactor, relay or timeswitch mounted in the contactor cabinet shall be barriered in its own compartment, and shall be installed on Lord sound absorbing mounts.
3. Contactor cabinets shall be of the same Manufacturer as the panelboards.
4. Where relays and/or contactors occupy the same enclosure as timeswitches they shall have a clear acrylic shield installed over each relay or contactor to guard line exposed parts from accidental contact by nonauthorized personnel.

2.10 DISCONNECTS (SAFETY SWITCHES)

A. General

1. Disconnect switches shall all be rated:

a. 600 volt 60Hz AC for all disconnect safety switches.
b. NEMA Type HD, quick-make, quick-break, H.P.-rated.
c. Fused Class "R", in NEMA Type I indoor location enclosure. Where enclosure is indicated outdoor or W.P. (Weather-Proof) switches shall be rain tight NEMA 3R enclosure. Lockable access door.
d. Number of poles horse power rating and amperage as indicated on the Drawings.

2. Provide internal neutral bus, ground-lug and conductor landing lugs, size to match conductors shown on Drawings. Switch access door shall be interlocked with switch to prevent access inside switch when switch is “on” closed position.
3. Maximum voltage, current and horsepower rating clearly marked on the switch enclosure and switches having dual element fuses shall have rating indicated on the nameplate.
4. Disconnect switch and fuses ampere rating shall also comply with Manufacturer’s recommendation for the connected load.

2.11 SPARE FUSE CABINETS

Provide a cabinet in each room where a switchboard or motor control center is installed and contains fuses. Cabinets shall be as specified for "Terminal Cabinets" and shall be of sufficient size to contain all spare fuses hereinbefore specified. Provide clips (two per fuse) for each spare fuse. Mount clips in plywood backboard in cabinet. Label cabinet "SPARE FUSES".

2.12 CONCRETE WORK (ADDITIONAL REQUIREMENTS)

A. Portland Cement

1. ASTM C33-(latest revision), Type II, Low Alkali Cement. Composed of Portland cement, coarse aggregate, fine aggregate, and water.

    a. Concrete for use as electrical equipment footings, lighting pole bases and equipment slabs on grade, concrete shall attain minimum 28-day compressive strength of 4000psi, using not less than 5.75 sacks of cement per cubic yard of wet concrete.
    b. Concrete for underground duct/conduit encasement, the minimum 28-day compressive strength shall be 2000 psi. Provide a minimum of 10-pounds of red oxide concrete coloring per yard of concrete.
    c. Mix shall obtain a 6-inches slump, measured with standard slump cone per ASTM C143/ C143M (latest revision).

2. Coarse Aggregate: Uniformly graded between maximum size not over 1½-inch and not less than 0.75-inch and minimum size #4, crushed rock or washed gravel. For concrete encased conduit only, maximum aggregate size shall be ½-inch.
3. Fine Aggregate: Clean, natural washed sand of hard and durable particles varying from fine to particles passing ⅜-inch screen, of which at least 12% shall pass fifty mesh screens.

B. Water: Clean and free from deleterious quantities of acids, alkalis, salts, or organic materials.

C. Reinforcement

1. Bars: Intermediate Grade Steel conforming to ASTM A615/A615M Grade 60, with pattern deformations.
2. Welded Wire Fabric: ASTM A185/A185M.
3. Bending: Conform to Requirements of ACI 318.

D. Form Material: For exposed work, use PS 1-66 "B-B Concrete Form" plywood forms, or equal. Elsewhere, forms may be plywood, metal, or 1-inch by 6-inch boards. Forms for round lighting pole bases shall be sono-tube.

2.13 SURGE PROTECTION DEVICE (SPD) – DIRECT CONNECT

A. General

1. The unit shall be modular in construction and operate in parallel with 60Hz AC line voltage, 4-wire or 5-wire, grounded or ungrounded systems, as applicable; voltage, kVA and ampere capacity as indicated on the Drawings. Suitable for direct connection through an external circuit breaker or combination switch/fuse protective device rated 30-amp, continuous duty, rated for Service Entrance equipment connection. Electrical surge protection sequences shall include circuit configurations as follows:

    a. Line-to-Line (Phase-to-Phase).
    b. Line-to-Ground (Phase-to-Ground).
    c. Line-to-Neutral, where neutral is present.
    d. Ground-to-Neutral, where neutral is present.

2. The unit shall operate correctly with any combination of resistive, inductive, or capacitate loads. The unit shall automatically shunt to ground the electrical transients and EMI/RFI noise occurring above the specified values. The unit shall automatically reset after transient condition has passed. Operating temperature minus 40° centigrade to plus 85° centigrade.
3. Provide one or more individual self-contained protection module(s) for each line voltage phase, ground and neutral, suitable for direct connect with line-side C/B protection and disconnect. Provide one spare individual plug-in protection module. Provide incoming line, neutral and ground conductor termination lugs rated CU/AL #14 through #4 AWG. Lugs shall be barriered from and prewired to the respective protection modules.
4. Provide a NEMA twelve housing to contain all unit modules, devices and conductor terminations. The housing shall include a hinged pad-lockable access door.

    a. Flush housing for mounting internally inside related equipment.
    b. Surface mounted, with conduit entrance knockouts for external mounting. Maximum housing size shall not exceed 36-inches wide by 72-inches high by 8-inches deep.

5. As manufactured by Total Protection Solutions Model #ST-SPD; or MCG Electronics; or Advantage Protection Technologies, Inc.

B. Operational Characteristics

1. Surge protection device, testing, listing and certification.

    a. UL 1449 (latest edition) and CSA listed and labeling, for Surge Protection Device Suppresser, UL 1283 for transient voltage electrical noise attenuation, ANSI/IEEE C62.45, C62.1 for C62.41, (latest edition) bi-directional transient clamping voltages for both Normal Mode and Common Modes against Category A and B ring wave and Category B impulse wave.
    b. The unit connected to the service entrance shall also withstand a minimum of 2,000-sequential ANSI/IEEE C62.41 Category C surges without failure following IEEE Test procedures in C62.1, C62.41 and C62.45.

2. Surge protection device, EMI noise rejection, and RFI noise rejection shall be provided for Common Mode (line-to-neutral and line-to-ground), Normal Mode (line-to-line) and neutral to ground.
3. EMI and RFI noise rejection.

    Conducted line noises interference both Electromagnetic (EMI) and Radio Frequency (RFI) shall be reduced by the unit over a continuous spectrum of 0.5MHz to 1.0MHz. The basis for reduction shall be a standardized 50-OHM insertion loss MIL -STD-220A test. Provide Spectrum Analysis Test dB attenuation reports showing RFI filtering over specified frequencies. Test data based on calculated or computer simulation is not acceptable.

4. Three phase and grounded "WYE" Performance Requirements.

Characteristics	208/120 Volt	480/277 Volt
Nominal line-to-line	208 Volt	480 Volt
Nominal line-to-neutral	120 Volt	277 Volt
Internal capacitance (Microfarads)	2.5	2.5
Maximum response time	1-nano second	1-nano second
EMI/RFI noise rejection	25-35dB	25-35-dB
Nominal peak clamp voltage line-to- neutral and line-to-ground	500 Volts	900 Volts
Minimum transient energy dissipation per phase (at 8x20 microseconds waveform)	1000 Joules	1500 Joules
Peak transient withstand (at 8x20 micro-seconds waveform) without failure of the unit	50,000 amp	60,000 amp

• Category-C3	300,000 amp	500,000 amp
• Category-B3	100,000 amp	150,000 amp
• Category-A3	60,000 amp	80,000 amp

C. Diagnostic Indicators

1. Shall display the "Normal" and "Fault" status of each line suppression circuit, along with protection circuit "on" indication.
2. Shall provide a sonic audible fault alarm with silence push-button.

D. Surge Protection Device Categories

1. Surge protectors shall comply with ANSI C62.41 (Latest Revision) Standard Protection Categories for "impulse" and "ringwave" transients, based on the installation locations shown in the Contract Documents.

    a. Service entrance, main switchboard or substation locations - Category "C3", high exposure, Type-1.
    b. Mid building, distribution panels, distribution panels over 400-amp main bus rating locations - Category "B3", high exposure, Type-1.
    c. Branch circuit panelboards 400-amp or less main bus rating - Category "A3", high exposure, Type-1.

2. The SPD short circuit current withstand rating shall exceed the actual short circuit current available at the SPD installation location

2.14 PLUG STRIP SURGE PROTECTION DEVICE

A. General:

1. Point-of-Use Type-3 self-contained unit rated 15-amp, nominal 120 volt plus-or-minus 10%, 60Hz, AC, 1875 watts full continuous load. Internal 15-amp resettable overload protection circuit breaker. Red illuminated on-off switch. 6-foot, 14 AWG 3-conductor, grounded, heavy duty jacketed AC line cord with NEMA 5-15 cap. Multi-outlet receptacles, suitable for use with the following types of plug in loads, data processing equipment, audio/video equipment, test instruments, medical equipment, photo graphic equipment and "switching type" power supplies.
2. Protected outlets shall be NEMA 5-15R 15-amp, AC 60Hz receptacles. Provide four protected outlet plugs on each plug strip, as indicated on the Drawings. Each group of two receptacles (duplex) shall be connected to separate protected load isolated filter banks. Each duplex shall be isolated from the other output receptacles, minimum isolation of 25dB at 1MHz line to line, line to neutral, line to ground and neutral to ground.
3. Non-blocking plug-in locations/orientation for plug-in "power-brick" power supplies, without obstructing adjacent receptacles.
4. As manufactured by TRIPP LITE-Isobar Series; or Advanced Protection Technologies; or equal.

B. Operation:

Self-contained RFI and EMF shielded housing with mounting slots for temporary mounting of the unit. Protected outlet receptacles shall supply filtered, electrical line voltage power to the connected equipment. Line noise RFI and EMI interference filtering suppression, and spike protection shall occur in all three modes of operation line to ground, line to neutral and neutral to ground rated as follows:

1. 13,000-amp, 210 joules (watt-seconds) peak withstands capacity.
2. Surge protection response time less than five nano seconds.
3. 140-volt AC RMS initiate spikes suppression 330 volt maximum let through.
4. RFI and EMI Suppression-Provide Spectrum Analysis Test dB attenuation reports showing RFI filtering over specified frequencies.

   50KHz greater than 20dB
   150KHz greater than 40dB
   1MHz greater than 80dB

5. Diagnostic indicator lights located on the SPD housing shall provide alarm alert for each of the following conditions:

   a. Loss of AC power.
   b. Damage, malfunction in the SPD suppression circuits.
   c. Improper AC electrical outlet wiring.

6. Standards Testing, Listing, Labeling and Certification Compliance, latest revisions:

   a. IEEE 587 A and B compliance.
   b. UL 1449 surge suppressers.
   c. UL 1363 temporary power taps.
   d. UL 1283 electromagnetic interference filters.

C. Rack Mounted SPD

1. SPD units installed in equipment racks shall comply with all of the same Performance Requirements, except as follows.

   a. EIA/TIA – Equipment rack mount style (19-inches or 24-inches as applicable).
   b. Minimum of two front mounted receptacle outlets and not less than six rear mounted receptacle outlets.
   c. 20-amp 120 volt 60Hz AC electric circuit rating, instead of 15-amp.

2.15 WIREWAY

A. General:

1. Unobstructed lay in type, metal wireway, fittings and connectors UL listed for use as wireway and auxiliary gutter. Length, elbows and "T-S" as shown on Drawings. Minimum cross-section size 4-inches by 4-inches, but not less than shown on the Drawings. Suitable for mounting in any position orientation.

B. Construction:

1. Minimum metal gauge shall not be less than 14 gages.
2. Cover shall be hinged entire length of cover. Cover shall be held in the closed position with bolts and nuts.
3. Provide spring nuts on all hardware fastener penetrations into the interior of the wireway to protect against wire insulation damage.
4. The inside of 90-degree corners in the wireway shall be a 45-degree bevel.
5. Grounding continuity between wireway sections and fittings shall be continuous the entire length of the wireway.

C. Finish:

1. Indoor non-raintight, rust inhibitor phosphatizing base coating and baked enamel finish, Manufacturer's standard color.
2. Raintight outdoor-galvanized metal, with corrosion resistant phosphate primer and baked enamel finish, Manufacturer's standard color, NEMA 3R construction.
3. All hardware shall be plated to prevent corrosion.

2.16 TRANSFORMERS

A. General

1. Provide dry type transformers constructed to meet Underwriters' Laboratories Specification UL 506 and tested in accordance with ANSI and NEMA Standards. Performance on transformers equal to or better than ANSI, NEMA, IEEE and CEC/NEC published criteria.

   a. 60Hz AC line and load.

2. UL Class 220°C insulation with maximum winding temperature rise of 150°C in 40°C ambient at 100% continuous rated capacity with overload capacity per ANSI C57.12 and C57.96 vacuum impregnated core and coil insulation. Transformer efficiency shall meet or exceed NEMA-TP1 (latest revision) Requirements.
3. Transformers shall be equipped with not less than five 2.5% full capacity voltage taps, two above and three below normal voltage. Line and load terminals shall be accessible, located behind removable front cover plate. Transformer connects shall terminate in “conductor-lugs” to match line side incoming and outgoing secondary side conductors, shall occur on a common (same) side of trans-former on insulated supports.
4. Provide wall mount and ceiling mount transformers support brackets, platforms and attachment structures for transformers.
5. Dry type transformers shall meet or exceed NEMA TP-1 (latest revision), Class-1 efficiency levels and shall be marked as energy efficient for United States Department of Energy and Environmental Protection Agency DOE/EPA “Energy Star”.
6. Transformer windings shall be copper or aluminum.
7. Electrostatic Shield: Provide full width, copper, 100% electrostatic shield (Faraday Shield), between line and load transformer windings, on each transformer phase. Shield shall be low impedance grounded to the transformer metal frame and shall attenuate common mode electrical noise 120dB at 1-500MHz range and transverse mode electrical noise, 30dB at 1-500MHz range. Average effective coupling capacitance of thirty picofarads between line and load sides.

8. Connect transformers by one of the following methods:

    a. Under floor conduit resulting in no rigid connections to transformer (provide ground strap for equipment ground).
    b. Liquid tight flexible metal conduit (provide ground wire for equipment ground).
    c. Pullbox or wireways from transformer which are isolated from transformer with an approved sound absorbing neoprene gasket (provide ground strap for equipment ground).

9. The physical dimensions of the transformer shall not exceed the size shown on the Drawings.
10. Transformer and transformer mounting shall be designed and tested and comply with install location seismic earthquake resistance seismic loads, typical for floor, wall and ceiling mount/suspended transformers. Bolt floor-mounted transformers to floor and mounting brackets, provide isolation rubber mounts, on each attachment contact location.

B. Test Requirements:

1. The transformers shall be subjected to the following production tests:

    a. Applied Potential
    b. Induced Potential
    c. No Load Loss.
    d. Voltage Ratio.
    e. Polarity
    f. Continuity

2. The Manufacturer shall have performed the following additional tests on transformer units identical to the design type being supplied to this Specification. Proof of performance of these tests in the form of test data sheets shall be provided at the time shop drawings are submitted for approval.

    a. Sound Levels
    b. Temperature
    c. Full Load and 50% Load Losses for linear and nonlinear loads
    d. Voltage Regulation
    e. Impedance

C. Transformer Housing

1. Metal, air cooled enclosure

    a. Removable metal NEMA 1 enclosure, indoor location
    b. Removable NEMA – 3R enclosures, outdoor locations, with vent shields.
    c. Provide screen protected ventilation for all openings, including bottom of housing, to prevent accidental contact with internal components and prevent rodent/insect entrance.

2. Manufacture’s rust inhibitor primer and standard finish paint.
3. Removable lifting and skidding provisions.
4. Provide wall mount and ceiling mount transformers support brackets, platforms and attachment structures for transformers.

D. Sound Levels: Transformer sound levels, between no loads to full load, shall be guaranteed by the Manufacturer not to exceed the following values:

9kVA and below	40dba
10kVA to 50kVA	45dba
51kVA to 150kVA	50dba
151kVA to 300kVA	55dba
301kVA to 500kVA	60dba

E. K-Rated Transformers

1. Transformers shall comply with UL-1561 and IEEE-519, shall all be rated K4, for harmonic content electrical loads, in accordance with UL-1561 and IEEE C57.110 (latest revision), unless noted other-wise with other-K ratings on Drawings.
2. The transformers shall be specially designed and manufactured for non-linear electrical load which cause harmonic current and voltage distortion, with 3rd, 5th, 7th, 9th and 15th harmonic current and volt-age distortion.
3. Transformers, which are simply oversized larger than the specified kVA rating and then derated to the specified kVA rating to compensate for harmonic overloading, are not acceptable.
4. Secondary neutral connections rated at 200% of rated secondary phase current.
5. Transformers Manufactured by; Cutler Hammer; or General Electric; or Square D Co.; or Siemens.

F. Seismic Earthquake and Wind Loading Withstand, Testing and Certification (Additional Requirements)

1. The complete transformer assembly; including housings/enclosures, accessories, supports/anchors etc., shall be designed, manufactured and tested for wind loading for outdoor locations; earthquake seismic rated withstand for indoor and outdoor locations.
2. Shall withstand, survive and maintain continuous non-interrupted energized operation (running) during the seismic event occurrences. Continued normal energized operation after the wind event and seismic event occurrences have abated.
3. Shall include demonstrations of successful operation and run test after completion of seismic event shake-table simulation.
4. Provide three dimensional finite element analysis demonstrating anchorage and operational withstand of wind loading as follows:

   a. 110MPH-West Coast USA and Hawaii, per ASCE/SEI 7-10.

5. Acceptance test seismic qualification of proposed equipment shall employ triple axis shake-table simulation of the Required Response Spectrum (RRS) seismic event motion, certified and approved by the AHJ.
6. Seismic test shall be performed by a third party independent Test Laboratory. Wind Analysis and Seismic Testing and reports shall be certified, signed and “stamped” by PE Professional Engineer licensed and in good standing in the State, Civil Engineer or Structural Engineer.

PART 3 - EXECUTION

3.1 GROUNDING (ADDITIONAL REQUIREMENTS)

A. Grounding shall be executed in accordance with all applicable Codes and Regulations, both of the State of California and Local Authorities Having Jurisdiction.

B. Each pull box or any other enclosure in which several ground wires are terminated shall be equipped with a ground bus secured to the interior of the enclosure. The bus shall have a separate lug for each ground conductor. No more than one conductor shall be installed per lug.

C. The Maximum Resistance to Ground shall not exceed 5 ohms.

3.2 OUTLET AND JUNCTION BOXES

A. General:

1. Accurately place boxes and securely fastens to structural members. Where outlets are shown at same location but at different mounting heights, install outlets in one vertical line. Where outlets are shown at same location and mounting height, mount outlets as close together in a horizontal row as possible. Where the outlet boxes for switches and receptacles are shown at the same location and mounting height, mount in common outlet box with barriers between devices. Provide single piece multi-gang cover plate for close mounted outlet boxes. Where switches are shown on wall adjacent to hinge side of doors, box shall be installed to clear door when door is fully opened.
2. Flush mounted boxes shall be attached to not less than two parallel studs or structure members by means of metal supports. The supports shall span between and attach to the structure members.
3. Boxes above accessible ceilings shall be attached to structural members. Where boxes are suspended, they shall be supported independently of conduit system by means of hanger rods and/or preformed steel channels. Boxes shall be supported independently of all piping, ductwork, equipment, ceiling hanger wires and suspended ceiling grid system.
4. Surface mounted outlets shall be attached to concrete or masonry walls by means of expansion shields.
5. Floor boxes shall be installed level with finish floor and within adjustable limits of floor ring. Where outlets are shown at same or adjacent location, use multi-gang boxes.

    a. Provide cut-outs in the sub-floor assembly, to accept the recess depth of each electrical floor box. Provide added “fire-proof” applications on the bottom of each floor box location extending through the sub-floor. The “fire-proof” application shall be equal to the floor fire-assembly withstand rating.
    b. Poke-thru floor outlets, core drill floor for installation of poke-thru. Install “split-box” in the ceiling space of the floor below. If the ceiling space of the floor below is not accessible ceiling type (lift-out), then provide 12-inches round removable fire-rated stainless steel access panel and trim-ring in the finish ceiling for hand-access to poke-thru “split-box” above the ceiling.

6. Outlet Box Horizontal and Vertical Separation: Outlet boxes and device outlet rings installed flush in walls shall be horizontally and vertically separated by not less than 24-inches (edge of box to edge of box) from device outlet boxes and rings in common wall surfaces located on the opposite (back) side of the same wall.

    a. Where the separation cannot be maintained, provide a solid backing behind and completely enclosing each outlet box.
    b. The backing shall extend the width of the wall cavity (i.e., between "studs" or masonry cells) behind the box and 12-inches above and below the outlet box centerline, completely enclosing the outlet box.
    c. The backing shall consist of the following:

        1) ⅝-inch thick gypsum board anchored in place for "stud" wall construction.
        2) Solid "mortar" to completely fill the outlet box "cell" behind the box in masonry construction.

7. Provide metal outlet box for each device. Install devices in metal outlet boxes. Typical for all wiring devices including, switches, receptacles, line voltage devices, and low voltage/signal system devices.

B. Fire Wrap:

1. In fire rated walls and ceilings provide fire rated "box-wrap" around the outside of each outlet box placed in fire rated wall or ceiling. Install the fire wrap on exterior of box inside the wall or ceiling, to maintain the fire rating of wall or ceiling with the installed outlet boxes.

3.3 SWITCHES AND RECEPTACLES-DEVICES

A. General

1. Provide outlet boxes for all devices, switches, receptacles, both line-voltage and low-voltage.
2. Devices installed in wireways shall be installed flush in wireway assembly.
3. Install and screw attach devices into outlet boxes and wireways.
4. Provide ground circuit connections to all devices.
5. Provide branch circuit connections to all devices.
6. Provide testing and commissioning for proper operation and phase/ground connectors.

    a. Test each GFCI devices and Arc-Fault devices after installation and circuit connection is complete.
    b. Test all devices for correct polarity and proper electrical energization.
    c. Test On-Off operation of automatically controlled outlets and receptacles.

7. Install and adjust all coverplates to be flush and level, with correct device and circuit identification.
8. Were one or more device occurs at the proximity with other similar devices, all of the devices shall be “granged” under one common coverplate as follows:

    a. Duplex convenience receptacles with other proximity (within 18-inches) duplex convenience receptacles.
    b. Lighting control switches not exceeding 20-amp switch rating with other proximity (within 18-inches) similar switches.

B. Line-voltage Plug-In Type Receptacle Installation Orientation:

1. The “ground-pin” shall face “up” at the receptacle top location (double duplex) 4-plex, individual and vertically mounted individual duplex receptacles.
2. The “neutral-blade” shall face “up” at the receptacle top location on horizontally mounted duplex receptacles.

3.4 CONCRETE WORK

A. Form:

1. Space forms properly with spreaders and securely tie together. Do not use twisted wire form ties. Keep forms wet to prevent joints from opening up before concrete is placed. Replace improper construction as directed. Do not use wood inside forms.
2. Build in and set all anchors, dowels, bolts, sleeves, iron frames, expansion joints and other materials required for the Electrical Work. Place all items carefully, true, straight, plumb, and even.

3. Carefully remove all exposed forms. Cut nails and tie wires below face of concrete and fill all holes. Rubbish will not be allowed to remain in, under, or around concrete.

B. Mixing: Use batch machine mixer of approved type. After ingredients are in mixer, mix for at least 1½-minutes.

C. Transit Mixing: In lieu of mixing at site, transit mixing may be used if rate of delivery, haul time, mixing time, and hopper capacity is such that concrete delivered will be placed in forms within 90-minutes from time of introduction of cement and water to mixer.

D. Placing of Concrete

1. Before placing concrete, remove wood, rubbish, vegetable matter and loose material from inside forms. Thoroughly wet down wood forms to close joints.
2. Clean reinforcement; remove paint, loose rust, scale and foreign material. Bars with bends not called for will be rejected. Hold securely in place to prevent displacement. Lap bar splices 24-diameters, min; lap fabric one mesh min. Tie intersections, corners, splices with 16-gallon annealed wire, or as otherwise called for.
3. Place concrete immediately after mixing. Do not use concrete that has begun to set; no tempering will be allowed. If chuting is used, avoid segregation. In placing new concrete against existing concrete, use bonding agent per Manufacturer's directions.
4. Give careful and thorough attention to curing of concrete. Keep concrete and forms wet for a minimum of 10-days, after placing concrete.

E. Concrete Finish

1. Finish of Exposed Concrete: Horizontal surfaces, steel troweled monolithic finish; vertical surfaces, smooth and free of fins, holes, projection, etc.
2. Exposed lighting pole bases shall be filled and sack finished to a smooth finish.
3. Remove concrete pour-forms.

3.5 SURGE PROTECTION DEVICE INSTALLATION (SPD)

A. Direct Connect SPD Installation

1. Install unit cabinet to insure a maximum connected circuit length of less than 5-feet from the equipment the surge protection unit is connected to, approximately plus 48-inches on wall.
2. Alternately, factory install SPD unit directly into respective equipment, instead of remote from equipment. Install SPD inside respective switchgear, switchboards, distribution panels, panelboards, etc.
3. Connect between surge protection unit and supply equipment with not less than 1.25-inch conduit containing 5#4 AWG, copper conductor, 600 volt THHN/THWN insulation, connection circuit.
4. Provide a subfeed overcurrent protective device in the respective panel or switchboard to supply the SPD connection circuit, whether or not shown on the Drawings. The protective subfeed device shall be a thermal magnetic circuit breaker rated not less than 30-amp 3-pole or a safety switch and fuse unit rated not less than 60-amp 3-pole, voltage and short circuit fault interrupting class to match the respective circuit voltage.
5. Connect surge protection unit to main building ground bus or electric distribution equipment ground bus (whichever is closer distance), with 1.25-inch conduit - 1#4 AWG copper conductor 600 volt, THHN/THWN insulation.

B. Plug-in type SPD

1. Install in respective equipment racks.
2. Install at respective workstation locations, cabinets and furniture.
3. Connect to respective equipment and wall electrical outlets.

C. Install, Connect, and Test each SPD Unit in Accordance with Manufacturer's recommendations.

3.6 WIREWAY INSTALLATION

Wireway hangers shall provide clamp type, hanger rod type, direct bolted bracket type from ceiling or walls as indicated on the Drawings and required for field installation locations. Supports shall be installed a minimum of 5-feet on center.

END OF SECTION 260501
040119/212227

SECTION 260505 - ELECTRICAL DEMOLITION

PART 1 GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with demolition, furnishing, delivery and installation of the work of this Section, complete, as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to, the following:

1. Examine all other Sections for work related to those other Sections and required to be included as work under this Section.
2. General Provisions and Requirements for electrical work.

1.2 GENERAL SUMMARY OF DEMOLITION WORK

A. The Specifications and Drawings are intended to cover a complete installation. The omission of expressed reference to any item of labor or material for the proper execution of the work in accordance with present practice of the trade shall not relieve the Contractor from providing such additional labor and materials.

B. Refer to the Drawings and Shop Drawings of other trades for additional demolition Requirements which affect the proper installation of this work. Diagrams and symbols showing electrical connections are diagrammatic only. Wiring diagrams do not necessarily show the exact physical arrangement of the equipment.

C. It is the Contractor's responsibility to visit the site and become thoroughly familiar with all features of the building and site which may affect the proper performance of this work.

D. Portions of these Plans have been derived from information taken from original Electrical Plans. The intent of the Drawing and Specifications is to provide a complete and operable system.

1.3 LOCATIONS OF EQUIPMENT

A. The Drawings indicate diagrammatically the locations or arrangements of conduit runs, outlets, equipment, etc. Proper judgment must be exercised in executing the work so as to secure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structure conditions encountered.

B. In the event changes in the locations or arrangements are necessary, due to existing conditions in the building construction or arrangement of furnishings or equipment, such changes shall be made without cost, providing the change is ordered before the work directly connected to same is installed and no extra materials are required.

1.4 UNDERGROUND DETECTION SERVICES

A. Services shall be provided utilizing the latest detection equipment available. Services available from Underground Technology Incorporated, phone (800) 366-7801. Services shall be performed by a company regularly engaged in the business of Underground Detection for the past 5-years.

B. Prior to excavation the following work shall be performed:

1. Obtain all available Record Drawings of the site from the Owner.
2. Obtain vellums of Civil Site Drawings for use in indicating existing underground systems.
3. Contractor to mark trenching locations and indicate width and depth.
4. Locate, by way of horizontal control, existing detectable sub-grade power conduits, fire alarm, communication, signal, sewer, water, gas, storm drain and irrigation lines in the affected areas.
5. Arrange and meet with the Owner's Representative to review existing underground conditions.
6. Exercise extreme caution in excavating and trenching on this site to avoid existing underground utilities, and to prevent hazard to personnel and/or damage to existing underground utilities or structures. These Drawings and Specifications do not include necessary components for construction safety, which is the responsibility of the Contractor.
7. Repair/replace to the satisfaction of the Owner, any work damaged that was identified in the Record Drawings provided, noted by the Owner’s Representative, or identified by the Underground Detection Services performed.
8. The Contractor shall contact Underground Service Alert of Southern California, (800) 422-4133, at least 48 hours prior to excavation, and shall not excavate until verification has been received and that public utilities serving the site have located and marked.

C. The locations of existing underground utilities, where shown on Drawings, are shown diagrammatically and have not been independently verified by the Owner or its Representative. The Architect and his Consulting Engineers are not responsible for the location of underground utilities or structures, whether or not shown or detailed and installed under this or any other Contracts.

1.5 SUBMITTALS

A. Schedule: Submit proposed outage schedule.

B. Provide a sequence of demolition to insure uninterrupted use of occupied facilities, which are to remain in operation during the Contract period.

1.6 CUTTING AND PATCHING

Perform cutting and patching of the construction work which may be required for the proper demolition of the electrical work. Patching shall be of the same material, thickness, workmanship and finish as existing and accurately match surrounding work to the satisfaction of the Architect. Cutting of Structural members shall not be done without notifying the Architect and obtaining structural approval.

1.7 ASBESTOS, POLYCHLORINATED BIPHENYL (PCB) OR HAZARDOUS WASTE:

It is understood and agreed that this Contract does not contemplate the handling of asbestos, PCB or any hazardous waste material. If asbestos, PCB or any hazardous waste material is encountered, notify the Owner immediately. Do not disturb, handle, or attempt to remove.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.1 THE SCOPE OF THE DEMOLITION WORK SHALL INCLUDE ALL LABOR, MATERIALS, SERVICES, AND EQUIPMENT REQUIRED TO PROVIDE THE SPECIFIED NEW WORK. THIS WORK INCLUDES, BUT IS NOT LIMITED TO, THE FOLLOWING:

A. Exercise extreme caution in excavating and trenching on this site to avoid existing ducts, piping, conduits, and utilities.

B. Refer to Architectural Drawings for ceiling removal locations. Except as noted otherwise, disconnect and remove all existing ceiling mounted lighting fixtures, smoke heat detectors, outlets and junction boxes, speakers, exposed wiring, raceways, and all other electrical devices and hardware attached to the ceiling structure.

C. Refer to Architectural Drawings for wall removal locations. Except as noted otherwise, disconnect and remove all existing wall mounted receptacles, data outlets, telephone outlets, fire alarm devices, security devices, wiring, raceways, outlet boxes and all other electrical devices and hardware attached to the walls.

D. All conduits rising from below grade to areas where partitions, walls, and/or other construction entities are indicated as being removed shall be cut to below finish floor, capped, and abandoned. Provide patching as required.

E. Where new partitions or other construction will cover existing outlets or fixtures making them inaccessible, move these outlets and conduits as required, or make other provisions so that the outlets will remain accessible and operational.

F. Relocate existing wiring, cabling, conduits and outlets from areas where plenums or roof openings are being provided.

G. Where existing walls and ceilings are to remain, provide blank covers or plates for outlets where fixtures or devices are removed under this Contract. Prime blank plates and paint to match surrounding area.

H. All existing panelboards, signal terminal cabinets, equipment racks, cabinets, disconnect switches; pullboxes, etc. shall remain unless noted otherwise on Plans.

I. Disconnect and remove all existing signal system conduits, surface raceways wiring and cabling for tele-phone, data network, public address speakers, audiovisual systems, projectors, clocks, and fire alarm devices, intrusion detection device, television outlets unless noted otherwise on Plans.

J. Seal all abandoned floor penetrations in manner acceptable to the Architect.

K. Repair and/or replace roofing materials, ceiling tiles, fixtures, etc. damaged by this construction.

L. Openings in existing fire rated partitions barriers, floors, ceiling etc. shall be sealed tight with UL and NEPA fire stop material equal to fire rating of the penetrated surface.

M. Install all new conduits concealed in walls or furred ceilings.

N. Remove all exposed conduit, wire, outlets, disconnect switches and electrical mounting hardware for equipment removed.

O. Provide weatherproof caps on abandoned conduits penetrating the roof. Repair roofing damaged by removal of existing electrical equipment.

P. For clarity, miscellaneous equipment, and raceways not related to Project are not shown.

Q. All dimensions and locations of equipment are approximate. Contractor shall field verify all dimensions.

R. Immediately notify the On-Site Inspector and Owner of any damage to new or existing work.

S. Repair/replace all damaged or defective work, materials, and equipment to the Architects satisfaction.

T. All removed materials and equipment, which in the opinion of Architect are salvageable, shall remain the property of the Owner. Deliver such salvaged materials and equipment on premises as directed, neatly pile or store them and Protect from damage. Where materials and equipment have been removed and not replaced the exposed surface shall be painted to match surrounding surfaces. Do not reuse materials and equipment, unless specifically indicated on Plans or specified. Remove from premises and dispose of all materials considered by Architect to be scrap.

END OF SECTION 26 05 05
040119/212227

SECTION 260530 - CONDUIT AND WIRE

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other Sections for work related to those other Sections and required to be included as work under this Section.
2. General Provisions and Requirements for electrical work.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Submit product data sheets for all wire, supports, conduit, fittings and splicing materials.

B. Submit material list for all conduit and conduit fittings.

C. Submit Details and Structural Engineering Calculations for conduit support systems.

PART 2 - PRODUCTS

2.1 CONDUIT

A. General

1. The interior surfaces of conduits and fittings shall be continuous and smooth, with a constant interior diameter. Conduits and conduit fittings shall provide conductor raceways of fully enclosed circular cross section. The interior surfaces of conduits and fittings shall be without ridges, burrs irregularities or obstructions. Conduits and fittings of the same type shall be of the same uniform weight and thickness.
2. Type of conduit, type of conduit fittings and conduit supports shall be suitable for the conditions of use and the conditions of location of installation, based on the Manufacturer's recommendations and based on applicable Codes.
3. All fittings for metal conduit shall be suitable for use as a grounding means, pursuant to the applicable Code Requirements. All metal conduit and metal conduit fittings shall provide 3 second duration ground fault current carrying ratings, when installed and connected to the respective conduit, as follows:

a. RMC and EMT conduit fittings.

1) 0.5 inch through 1.5 inch conduit/fitting size - 10,000 amp RMS.
2) 2.0 inch and larger conduit/fitting size - 20,000 amp RMS.

b. FMC and LTFMC Conduit Fittings

1) 0.5 inch through 1.25-inch conduit/fitting size-1,000 amp RMS (without external bonding jumper).
2) 1.5 inch through 4.0-inch fitting size-10,000 amp RMS with bonding jumper.

4. Protective corrosion resistant finish for metal conduit fabricated from steel and metal conduit fittings fabricated from steel, shall be as follows:

   a. Clean all metal surfaces (including metal threads) with acid bath "pickle" prior to coating, to remove dirt, oil and prepare surfaces for galvanizing.
   b. Hot-dip galvanized zinc coating on all interior and exterior steel surfaces. Minimum finish zinc coating thickness shall not be less than 0.002 inches.
   c. Threads shall be hot-dip zinc coated after machine fabrication.
   d. Exterior metal surfaces shall be finished with clear organic polymer topcoat layer, after galvanizing.
   e. The inner metal surfaces of conduit fittings shall be finished with a lubricating topcoat after galvanizing, to facilitate conductor pulling through the conduit/fitting.

5. Threads for metal conduit and metal conduit fittings shall be taper-pipe-thread, National Pipe Standards (NPS) and shall comply with ANSI-B1.20.1.
6. Metal conduit termination connector fittings shall be provided with a Manufacturer installed, insulating throat bushing inside the fitting. The bushing shall protect the wire conductor insulation from cutting, nicks and abrasion during conductor installation and electrical load "cycling" after installation is complete. The bushing shall comply with UL 94V-0 flammability.
7. Provide conduit bonding/grounding jumper from metal enclosures with "concentric ring" knockouts, to positively ground/bond each respective conduit(s) to the metal enclosure.
8. Metal conduit fittings connecting to PVC coated metal conduit shall be PVC coated to match the conduit.
9. The conduit and fittings shall be watertight and airtight without cracks and pinholes.

B. Rigid Metal Conduit (RMC)

1. Rigid metal, round tubing, machine threaded at both ends.

   a. The conduit and conduit fittings shall comply with the Requirements for an equipment grounding conductor, pursuant to applicable Codes.

2. RMC raceway types shall be as follows:

   a. Rigid Galvanized Steel conduit (RGS), minimum yield strength shall be 35,000 PSI. Shall comply with NEMA Standard 5-19 (latest revision); ANSI C80.1 and ANSI-C80.4 (latest revision); UL 514-B and UL 6 (latest revisions); National Pipe Standard Specification (latest revision).
   b. Intermediate steel Conduit (IMC). Shall comply with NEMA Standard 5-19 (latest revision) ANSI-C80.6 (latest revision); UL 2142 (latest revision).

3. RMC fittings:

   a. Fittings shall be compatible with RGS and IMC.
   b. Fittings shall be rated "liquid tight".
   c. Fittings imbedded in concrete shall be rated "liquid tight" and "concrete tight".
   d. Connectors and couplings for terminating, connecting and coupling to RMC conduit shall be threaded metal.

e. Fittings shall comply with ANSI C80.4 and ANSI C33-84 (latest revision); NEMA FB1 (latest revision); UL 514 (latest revision).
f. Conduit seal fittings:

1) Conduit seals shall prevent the passage of gasses, liquids and vapors past the location of the seal installation in the conduit.
2) Conduit seals shall be suitable for installation in both vertical and horizontal conduit locations.
3) Conduit seals shall be visible and accessible for inspection after installation is complete.
4) Conduit seals shall be rated for the following locations:

a) Wet locations
b) Classified hazardous location materials NEC Class 1 Division 1.
c) Temperature ranges from 0 degrees centigrade through 90 degrees centigrade.

5) Conduit seals, sealing compound and sealing compound dam shall be the products of the same Manufacturer.

4. RMC fittings as manufactured by:

a. For threaded enclosure, termination connection.

1) Thomas & Betts – 106 Series bonding locknut, 5302 Series sealing ring with stainless steel retainer.

b. For non-threaded enclosure, termination connector.

1) Thomas & Betts – 370 Series watertight threaded sealing hub, 106 Series threaded bonding lock nut, Sta-Con Series enclosure bonding jumper and 3870 Series threaded ground bushing.
2) Emerson-OZ/Gedney-CHMT/CHT watertight threaded hub with bonding locknut and GH50G Series enclosure bonding jumper.

c. For RMC to RMC conduit-to-conduit coupling

1) Thomas & Betts/Erickson - 674 (threaded) Series
2) Emerson-OZ/Gedney Type TPC (threaded) Series
3) Threaded RMC conduit couplings, product of the same Manufacturer as the RMC conduit.

d. For RMC Conduit Seals

1) Emerson-OZ/Gedney-EYA and EYAM (threaded) Series
2) Appleton-EYF and EYM (threaded) Series

C. Electrical Metallic Tubing (EMT)

1. Rigid metal round tubing, “thin wall” steel construction, with non-threaded ends.

    a. The conduit and conduit fittings shall comply with the Requirements for an equipment grounding conductor pursuant to applicable Codes.
    b. The conduit shall be watertight and airtight without cracks and pinholes.

2. EMT shall be allowed for conduit size ranges from 0.5-inch through 4.0-inches.
3. Comply with ANSI C80.3, C80.4, and ANSI C33.98 (latest revisions); UL 594 and UL 797 (latest revisions); CEC Section 12500 (latest revision).
4. EMT fittings:

    a. Connectors and couplings for terminating, connecting and coupling to EMT conduit shall be non-threaded steel fabrication.
    b. EMT termination connector fittings shall be as follows:

        1) Set screw type “concrete tight” when installed in dry interior locations.
        2) Compression types “raintight” and “concrete tight” when installed in wet or damp locations, outdoors and in concrete or masonry construction.

    c. Fittings shall comply with ANSI C33.84 (latest revision); UL 514 (latest revision); NEMA FB-1.

5. EMT fittings as manufactured by:

    a. For threaded and non-threaded enclosure, termination connector

        1) Thomas & Betts-TC721A (set screw type) Series (with locknuts).
        2) Emerson-OZ/Gedney-TC500I (set screw type) Series (with locknuts).
        3) Thomas & Betts-5123 (compression type) Series (with two locknuts).
        4) Emerson-OZ/Gedney-TC600I (compression type) Series (with locknut).
        5) Thomas & Betts-4240 (compression type) Series (90 degree angle with locknut).
        6) Emerson-OZ/Gedney-TWL (compression type) Series (90 degree angle with locknut).

    b. For EMT to EMT conduit-to-conduit coupling:

        1) Thomas & Betts-TK121A (set screw type) Series (with locknut).
        2) Emerson-OZ/Gedney-5000 (set screw type) Series (with locknut).
        3) Thomas & Betts-5120 (compression type) Series.
        4) Emerson-OZ/Gedney-TC600 (compression type) Series.

    c. For EMT to RMC conduit to conduit combination coupling:

        1) Thomas & Betts-HT221 (set screw type) Series.
        2) Emerson-OZ/Gedney-ESR (set screw type) Series.
        3) Thomas & Betts-530 (compression type) Series.
        4) Emerson-OZ/Gedney-ETR (compression type) Series.

D. Flexible Metal Conduit (FMC)

1. Round flexible conduit, fabricated from a single continuous steel strip. The steel shall be factory formed into continuous interlocking convolutions to form a complete lock between steel strips and provide raceway flexibility.
2. Metal to metal grounding contact shall be maintained throughout the length of the FMC conduit.
3. FMC shall be allowed for conduit size ranges from 0.5 inch through 4.0-inches.
4. FMC shall comply with ANSI-C.33.84 and ANSI C33.92; NEMA FB-1; CEC 12-1100.
5. FMC Fittings

    a. FMC fittings shall be malleable iron construction or steel construction.
    b. Fitting shall automatically cause the FMC raceway throat opening to be centered with respect to the fitting throat opening.
    c. Straight and angled connector termination fittings shall be threaded on one end and shall include a threaded locknut, suitable for connection to threaded and unthreaded enclosures.
    d. The attachment of the fittings to FMC shall be angled saddle type, to engage and interlock with the FMC spiral groove, and shall be unaffected by vibration. Direct bearing screw type fittings shall not be used.
    e. Direct FMC conduit-to-FMC conduit coupling of FMC shall not be permitted.
    f. Shall comply with ANSI C33.9, and ANSI C33.92 (latest revision); NEMA FB1 (latest revision); UL 514.

6. FMC fittings as manufactured by:

    a. Straight Termination Connectors: Thomas & Betts-3110 Series (with locknut); 45 and 90 Degree Angle Connectors: Thomas & Betts-3130 Series (with locknut)
    b. FMC to EMT conduit combination coupling: Thomas & Betts 503TB Series.

E. Liquid Tight Flexible Metal Conduit (LTFMC)

1. The metal conduit core of LTFMC shall comply with the same Requirements as FMC conduit, with the addition of a thermoplastic exterior flexible jacket over the metal core.
2. The exterior jacket shall be positively locked to the metal core to prevent jacket “sleeving”.
3. The LTFMC shall be rated for installation and operating service temperatures of between minus 20 degrees centigrade through plus 90 degrees centigrade.
4. The LTFMC jacket shall be suitable for continuous exposure to sunlight, rainwater, water vapor, mineral oils and liquid solvents, without penetrating into the conduit and without deteriorating the jacket.
5. LTFMC sizes from 0.5-inch through 1.25-inch shall include an additional internal ground conductor, fabricated by the Manufacturer, as an integral part of the conduit core.
6. Direct LTFMC conduit-to-LTFMC conduit coupling of LTFMC shall not be permitted.
7. LTFMC shall be allowed for conduit size ranges from 0.5-inch through 4.0-inches.
8. In addition to the Requirements for FMC conduit, LTFMC shall also comply with ANSI C-33.84 (latest revision); NEMA-FB1 (latest revision); CEC 12-1400 (latest revision).
9. LTFMC fittings

    a. Fittings shall include an external mechanical ground/bond wire connector.
    b. The attachment of the fitting to LTFMC shall be threaded compression type onto the conduit core with locknut and liquid tight jacket compression seal. The fitting shall automatically prevent “sleeving” of the jacket.
    c. Straight and angled termination connector fittings shall be threaded on one end and shall include locknut suitable for connection to threaded and unthreaded enclosures.

10. LTFMC fittings as manufactured by:

a. Termination connector fittings:

	Straight	45 and 90 Degree Angle Connectors
1)	Thomas & Betts-5331 GR Series.	Thomas & Betts-5341GR & 5351GR Series.
2)	Appleton-STB & STN-L Series for with preformed "knockouts".	Appleton-STB-L Series; STN-L Series for use use with preformed "knockouts".
3)	Emerson- OZ/Gedney-4Q Series.	Emerson-OZ/Gedney-4Q Series

b. LTFMC to RMC conduit to conduit combination coupling fittings:

1) Thomas & Betts-5271 GR Series.
2) Emerson-OZ/Gedney-4Q Series

F. Rigid Non Metallic Conduit (RNMC)

1. General

a. Conduit and fittings shall be 90 degree centigrade conductor rated. Fabricated from homo-geneous material, free from visible cracks, holes or foreign inclusions, with integral "end-bell". The conduit and conduit fittings shall be watertight and airtight.
b. Conduit, conduit fittings and conduit fitting assembly "solvent cement" shall all be the product of the same Manufacturer. Conduit fittings shall be solvent cement welded watertight.
c. Conduit and fittings shall be identified with legible markings showing ratings, size and Manufacturers name.
d. RNMC and fitting shall be corrosion resistant, watertight.
e. Conduit shall be suitable for conductor operating temperatures from minus 20 degrees centi-grade to 90 degrees centigrade.
f. RNMC shall comply with NEMA TC-2 (PVC 40 conduit, latest revision) NEMA TC-6 (EB conduit latest revision) and NEMA TC-3 (fittings, latest revision); UL 514 and UL 651 (latest revision).

2. Polyvinyl Chloride (PVC)-RNMC

a. PVC-Schedule 40 heavy wall construction.
b. PVC-Schedule 80 extra heavy wall construction.
c. PVC-Type EB.

3. RNMC fittings connecting to metallic raceways shall be provided with a ground/ bond jumper connection.

G. Combi-Duct

1. Rigid nonmetallic conduit combining a continuous linear outer raceway (duct) with factory installed (inside the outer duct) multiple, segregated inner raceway (ducts). Rigid, Schedule 40 PVC construction. Shall be modular lengths of 20-feet for each duct segment.
2. The conduit shall be suitable for use with signal/telecommunications, fiber optic, telephone and computer/data circuits, operating at 100 volts or less, UL listed and labeled.
3. Outer Duct, outer enclosing Schedule-40 PVC duct size. The outer enclosing duct shall be 4.2-inches inside nominal duct diameter and 4.5-inches outer duct nominal diameter.
4. Inner-ducts (contained inside the enclosing outer duct), non-metallic SDR-19 or Type-C/CAO-8546:

Triple Combi-Duct

a. Quantity of three continuous round rigid inner linear ducts, nominal size inside diameter 1.5-inch for each inner duct.
Quad Combi-Duct
b. Quantity of four continuous round rigid inner linear ducts, nominal size inside diameter 1.19-inch for each inner duct.

5. Manufacturer's standard bends and offsets, minimum 72-inches radius.
6. Combi-duct and combi-duct fittings shall be airtight and watertight. Approved for direct burial in earth and approved for encasement in concrete.
7. As manufactured by Carlon # Multi-Guard/Multi-Cell Series; American Pipe and Plastic (AMTEL) #Multi-Bore Series; or equal.

H. Expansion Joint, Deflection Joint and Seismic Joint Conduit Fittings

1. Expansion Conduit Fitting – Fitting shall provide for a minimum of 2-inches straight line movement between two connecting conduits in each direction (total 4-inches conduit expansion and Contraction) parallel to the respective conduit lengths. Fitting shall be watertight.
2. Deflection Conduit Fitting – Fitting shall provide for a minimum of 30 degrees angular deflection movement ("Shear" deflection) between two connecting conduits, in any direction perpendicular to the length of the respective conduits. Fitting shall be watertight.
3. Combination Expansion/Deflection Conduit Fitting – Fitting shall provide the combined "expansion" and "deflection" movement capacity between two connecting conduits as described for separate "expansion" and "Deflection" conduit fittings. Fitting shall be approved for installation concealed in both masonry/concrete construction and exposed non-masonry/concrete construction. Fitting shall be watertight.
4. Fittings shall comply with UL.
5. Fittings as manufactured by:

a. Conduit expansion fittings exposed or concealed locations as manufactured by:

1) Emerson-OZ/Gedney – AXB-8 Series for RMC conduit.
2) Emerson-OZ/Gedney - TX Series for EMT conduit.
3) Appleton – AXB or XJ8 Series for RMC conduit and EMT conduits. Provide RMC to EMT combination conduit coupling fittings for each end of the expansion fitting.

b. Combination expansion/deflection conduit fittings exposed or concealed conduit locations as manufactured by:

1) Emerson-OZ/Gedney - AXDX Series for RMC conduit.
2) Emerson-OZ/Gedney - AXDX Series for EMT conduit.
3) Appleton-DX Series for RMC conduit.
4) Provide RMC to EMT combination conduit coupling fittings for each end of the expansion/deflection fitting.

c. Conduit expansion/deflection fittings for FMC and LTFMC conduit.

1) Provide a minimum of 12-inches of "slack" LTFMC in each FMC or LTFMC conduit at building and structure seismic or expansion joint conduit crossings.

2) Note: Each FMC "slack" expansion/deflection location, shall be considered as not less than a 90 degree conduit bend location, for compliance with the maximum quantity of conduit bends allowed in a raceway.

6. Conduit fitting bonding jumper:

a. The grounding/bonding path of metal conduit shall be maintained by the fitting.
b. Provide a bonding jumper at each expansion, deflection and combination expansion deflection conduit fitting.
c. The jumper shall be a bare flexible copper "braid". The copper braid electrical current carrying capacity shall be equal to the metal conduit.
d. Provide a factory terminated ground clamp on each end of the braid with adjusting steel conduit grounding clamps and connect to each respective conduit end.
e. The jumper braid length shall be 8-inches longer than the respective conduit fitting.
f. Bonding jumper for FMC and EMT fittings as manufactured by:

1) Emerson-OZ/Gedney – BJ and BJE Series
2) Appleton – BJ/XJ Series

I. Conduit Bodies Conduit Fitting

1. Conduit bodies shall provide conductor access with a removable conduit body cover and wiring area enclosed in metal housing. The conduit body shall facilitate pulling conductors.
2. In-line form "C" conduit bodies shall be prohibited.
3. The interior space "length" of 90 degree "elbow" conduit bodies shall not be less than six times the diameter size of the largest conduit connecting to the conduit body.
4. Conduit body covers shall be removable, gasketed; watertight "domed" metal covers "Mogul-Type" with threaded screw attachment to the conduit body.
5. Lubricated, reusable, wire roller guards inside the conduit body shall protect wire from insulation damage during wire "pulling".
6. Conduit body fittings shall comply with UL 514.
7. Conduit bodies as manufactured by:

a. For RMC Conduit

1) Hubbell/Killark – LB/Mogul (90-degree elbow) Series – threaded body.
2) Emerson-OZ/Gedney - LB 6X/Mogul (90 degree elbow) Series - threaded body.
3) Appleton – NEC6X-LB/Mogul (90 degree elbow) Series - threaded body.

b. For EMT Conduit

1) Same as for RMC conduit. Provide EMT to RMC conduit combination coupling fitting for each outlet body connection.

2.2 PVC COATING

A. PVC coatings shall be provided as described for specified metal products.

B. PVC coating shall be factory applied, to comply with NEMA-RN1 and 5-19.

C. The adhesion of the PVC coating to the coated metal shall exceed the strength of the coating itself, based on 0.5-inch "strip-pull" test.

D. Uniform coating thickness shall be continuous without "breaks" or "pinholes" and shall not be less than the following:

1. Exterior metal surfaces, 40-millimeter coating thickness.
2. Interior metal surfaces, 10-millimeter PVC or urethane coating thickness (i.e. interior of conduits, interior of conduit fittings etc.).

2.3 CONDUIT SUPPORTS

A. General

1. Conduit Supports, hangers and fasteners for metal conduit shall be steel, hot dip zinc galvanized.
2. Conduit supports, hangers and fasteners for PVC coated conduit shall be PVC coated to match the conduit PVC coating.
3. Threaded hardware shall be continuous, free running threads.
4. Conduit support systems, including support channels, pipe clamps, braces, anchors, hardware, fasteners, shall be sized to support the full capacity circuit conductors weight, plus the installed conduit weight, plus the conduit fitting weight and support hardware weight, plus a 300% additional weight capacity safety factor.
5. Provide lock washer at each "bolted"/threaded connection.
6. Conduit supports, fasteners, channels, braces, hardware, anchors, pipe clamps, and hangers as manufactured by Unistrut or Kindorf.
7. Supports shall be free of "BURRS" and sharp edges.
8. Metal supports cut in the field shall be zinc galvanized after cutting to prevent rust.

B. Conduit Hangers

1. Threaded steel hanger rods.

    a. Hanger rods smaller than 0.375-inches in diameter shall not be used for support of individual conduits.
    b. Hanger rods smaller than 0.5-inches in diameter shall not be used for support of multiple conduits.

2. Conduit hanger wires shall be not less than 12-gauge steel.
3. Conduit hangers shall attach to structure fasteners with steel "Clevis" or "Swing" hangers and shall provide a minimum of 45 degrees of angular movement in any direction at the point of the conduit hanger attachment to the structure fasteners.
4. Conduits individually suspended by conduit hangers shall fasten to the respective hangers with "Clevis" type pipe hangers. The pipe hangers shall be steel, adjustable to fit conduit size and shall completely enclose the conduit circumference.

C. Conduit Support Channels

1. "C" channels shall be factory preformed with a minimum 12 gauge thickness metal. The channel shall be factory "punched" with regularly spaced slotted holes for fastener attachments along the length of the channel.
2. The "C" channel shall not deflect more than 0.1 inch between channel supports at maximum installed design load, including required safety factor.
3. Channels shall comply with ANSI-1008 (latest revision) and ASTM-A569 latest revision).
4. Channels shall provide "turned lips" at longitudinal edges to hold (lock-in) fasteners.
5. Conduit support channels suspended from conduit hangers shall attach to conduit hangers with treaded connections. Provide a minimum of two hangers (trapeze style) connected to each channel.
6. Non-suspended conduit support channels shall connect to structure fasteners with threaded connectors.

D. Fasteners, Seismic Earthquake Rated

1. Channel fasteners:

   a. Channel fasteners shall "prelocate" and lock into the channel "turned lips" and channel "walls".
   b. A separate metal strap shall "tie" each conduit to each channel with conduit channel fasteners.

2. Structure fasteners:

   a. Structure fasteners for wall and floor mounted conduit attachments shall attach to existing masonry and concrete structures with structure fasteners using drilled, mechanical, expansion shield anchors.
   b. Structure fasteners for wall and floor mounted conduit attachments shall attach to new masonry and concrete structures with structure fasteners using steel threaded inserts precast into the structures.
   c. Structure fasteners shall center the support load above or below the beam flanges and reduce torsion-rotation forces exerted on the structural beam. Attach to steel structural members with "swing-beam clamps", with set-locking screw structure fasteners.

      1) Beam clamps shall include integral safety rod, strap or "J"-hook to secure the attachment clamp to the beam flanges on both sides of the beam, with integral hanger rod attachment.
      2) Or double-ended beam clamp to secure the attachment clamp to the beam flanges on both sides of the beam, with integral hanger rod attachment.

   d. Structure fasteners for wall and floor mounted conduit attachments shall attach to wood structural members with flush "through-bolted" wood beam/ wood framing stud structure fasteners.
   e. Structure fasteners for wall mounted conduit attachments shall attach to steel framing studs and steel structural elements with spot welded steel structure fasteners or drilled and bolted structure fasteners.

E. Brace Connectors

1. Provide lateral brace connectors to resist horizontal, lateral and vertical movement of suspended conduits during seismic earthquakes.
2. The braces shall connect from each conduit support, attach as close to the conduit as possible, and attach to fixed rigid, nonsuspended building "main" structural elements with fixed anchoring.
3. Brace attachment connectors and fasteners shall be rigid preformed steel channels or flexible #10 gauge steel hanger wire.
4. Connect and attach the brace connectors to fixed structural elements in the same manner as conduit support hangers. The connection of braces to structural elements shall be independent of the conduit support hanger structure fasteners.

2.4 ELECTRICAL POWER WIRE AND CABLE

A. General

1. All wire and cable shall be single-conductor, annealed copper, insulated 600 volt, #12AWG minimum unless specifically noted otherwise on the Drawings.
2. Conductors #10AWG and smaller shall be solid. Conductors #8AWG and larger shall be stranded.
3. Insulation of conductor connected to circuit protection devices required to be "100%" rated, shall be 90 degree centigrade rated insulation.
4. Insulation of conductors installed outdoors, on grade or underground, insulation shall be rated for wet locations.
5. Insulation of conductors installed outdoors, installed exposed to the sun, installed in exposed conduits, insulation shall be rated for high-temperature 90 degrees centigrade.
6. Insulation of branch circuit conducts installed in light fixtures, insulation shall be rated for 90 degrees centigrade.
7. Conductor exposed to oil, insulation and jacket shall be oil resistant, complying with “Oil Resistant-1” and “Oil Resistant-2” UL 83.

B. Conductor Insulation

1. 600 Volt AC and/or DC insulated conductors installed entirely inside conduits, or enclosed inside wireways, or enclosed inside raceways, insulation shall be rated as follows.
2. Indoor above Grade locations either concealed or exposed.

    a. Dual rated THHN and THWN
    b. Individually rated THHN-2
    c. Individually rated THWN-2
    d. XHHW-2

3. Outdoor above Grade either concealed or exposed.

    a. XHHW-2
    b. THWN-2
    c. THW-2

4. Outdoor below Grade or outdoor on Grade.

    a. XHHW-2
    b. THWN-2
    c. THW-2

5. All other enclosed raceway locations not described above.

    a. XHHW-2
    b. THWN-2
    c. THW-2

6. Health Care facilities all circuits insulation shall be XHHW-2, rated Hospital-Grade.
7. 600 Volt AC and/or DC insulated conductors installed in open cable tray or open wireway or exposed insulation also shall be rated for exposed install locations.

C. Insulation Color Coding and Identification

1. The following color code for branch circuits:

   a. Neutral . . . White (Tape feeder neutrals with white tape near connections)
   b. Normal Power

120/208 Volt	480/277 Volt
Ground Green	Ground Green
Phase A Black	Phase A Brown
Phase B Red	Phase B Orange
Phase C Blue	Phase C Yellow

   c. Isolated ground insulation shall be green with a longitudinal yellow stripe.
   d. Emergency power same insulation color as normal power except as follows:

      120/208 Volt

      Provide an additional continuous stripe on each conductor insulation, orange or yellow, except ground

      480/277 Volt

      Provide an additional continuous stripe on each conductor insulation blue or black, except ground

2. When individual neutral conductors are shown/required for each branch circuit, the color code for the neutral conductors shall be as follows:

   a. 120/208 volt; Phase A - White with Black stripe; Phase B - White with Red stripe; Phase C - White with Blue stripe.
   b. 277/480 volt; Phase A - White with Brown stripe; Phase B - White with Orange stripe; Phase C - White with Yellow stripe.

3. Feeders identified as to phase or leg in each, switchboard, switchgear, panelboard and junction location with printed identifying tape.
4. Fire alarm conductors: Use 600-volt, type THHN-2/THWN-2 conductors and color-coded per Equipment Manufacturer's recommendations and approved and listed for use on fire alarm systems by the State Fire Marshal.
5. Color coding for mechanical and plumbing control wiring shall be an agreed upon color code between the Mechanical/Plumbing Contractor and the Electrical Contractor, and color code shall be submitted to the District’s Representative in writing for approval prior to installation.

2.5 CHEMICAL GROUND ROD

A. General

1. Self-contained ground rod(s) using chemically enhanced grounding shall be provided where specifically indicated on the Drawings. As manufactured by Lyncole XIT Grounding Systems, 22412 South Normandie Avenue, Torrance, CA. Telephone #(800) 962-2610; or Superior Grounding Systems, Irwindale, CA. Telephone # (800) 747-7925; or ERICO – Eritech Chemical Ground Electrode.

2. The ground rod shall operate from changes in atmospheric pressure pumping air through the ground rod, hygroscopically extracting moisture from the air to activate the ground electrolytic chemicals and improve the ground rod performance.
3. Ground rod system shall be UL-467 listed.
4. Ground rod system shall be 100% self-activating, sealed and maintenance free. The addition of chemical or water solutions shall not be required.

B. Ground Rod

1. Ground rod shall consist of a 2-inches nominal diameter hollow, copper tube. The tube shall be permanently capped on the top and bottom. Air breather holes shall be provided in the top of tube. Drainage holes shall be provided in the bottom and sides of the tube for electrolyte drainage into the surrounding soil.
2. The ground rod shall be chemically filled at the factory with environmentally non-hazardous water-soluble metallic salts to enhance electrical grounding performance.
3. Ground rod shall be a minimum of 10-feet long for straight (vertical) installation; or "L" shape minimum 20-feet long for horizontal installation.
4. Ground wire clamping "U-Bolt" with pressure plate on the top end of the tube sized for 1#2 through 500 MCM AWG ground electrode conductor connections, and stranded 4/0AWG copper pigtail exothermically welded to the side of rod for ground electrode conductor connection.

C. Ground Box

1. Precast concrete box with slots for conduit entrances. Approximately 10-inch diameter by 12-inches high. Cast iron grate flush cover with "Breather" slots XIT Box #XB-12.

D. Backfill Material

1. Natural volcanic, non-corrosive Bentonite Clay backfill material.
2. Shall absorb water at a minimum of thirteen times its dry volume or approximately 14 gallons for 50 pounds of clay.
3. PH Value 8-10 with maximum resistivity of 2.5 OHMS-M at 300% moisture content by weight.

2.6 FLEXIBLE CORDS AND PORTABLE CABLES

A. General

1. Multi-conductor insulated flexible cable with jacket rated extra heavy duty, extra hard-use and high abuse duty; ozone, sunlight, grease, oil resistant-UL 83 and water resistant; rated for indoor/outdoor use.
2. Quantity of conductors and conductor sizes as indicated on the Drawings but in no case less than five 16AWG.
3. Characteristics:

    a. Conductors - stranded copper, soft annealed conforming to ASTM-B-174 and ASTM-B-172. 600 volt individually insulated and color-coded. Separate green insulated ground conductor. Aluminum conductors shall not be permitted for cords and cables.
    b. Insulation - rubber conforming to UL 62; temperature range plus 105° Centigrade to minus 50° Centigrade.
    c. Flame resistance shall conform with MSHA-P123-103.
    d. Jacket - black for equipment connections and yellow for outlet connections. Rated for temperature range plus 105° Centigrade to minus 50° Centigrade, water, sun-light and ozone

resistant. Permanently mark jacket a minimum of 40-inches on center with rated voltage, Manufacturer's name, wire/insulation type, AWG conductor size and quantity (minimum 24-inches on center).

2.7 CABLE RACKS

A. Cable racks, installed on the vertical walls of the structure, including hooks and porcelain insulator cable cradles, shall be sufficient to accommodate the cables and splices.

B. Vertical racks shall be installed on all walls of the structure a minimum of 24-inches on center within 6-inches of floor and top of wall. A rack shall be installed within 18-inches of each corner of each wall. Additional racks spaced equally on each wall shall be installed; spacing between vertical wall racks shall not exceed 24-inches.

1. Wall racks shall be slotted to accept removable hooks and lock hooks into place.
2. Non-metallic, 50% (minimum) glass reinforced nylon or non-metallic material of the same characteristics.
3. The installed cable racks, cable support hooks with arms and wall anchor bolts shall support the following minimum loads for each hook/arm, with a 200% minimum safety factor. Based on multiple hook/arms located not less than 9-inches on center along the entire vertical length of the support rack:

	Hook/Arm Length	Min. Weight Each Hook/Arm Supported	Max. Allowable Hook/Arm Deflection
a.	8-inches	450 pounds	0.25-inch
b.	14-inches	350 pounds	0.37-inch
c.	20-inches	250 pounds	0.37-inch

(Based on load concentrated 1-inch from the end of each hook/arm.)

4. Racks shall be bolted to the precast and cast-in place structure walls, within 3-inches of each rack end and not less than 9-inches on center. Provide cast-in place or after-set drilled expansion concrete anchors.

PART 3 - EXECUTION

3.1 TRENCHING, FOOTINGS, SLEEVES

A. Provide trenching, concrete encasement of conduits, backfilling, and compaction for the underground electrical work, in accordance with applicable Sections of this Specification.

B. Provide footings for all post and/or pole-mounted lighting fixtures: concrete shall conform to the applicable Sections of this Specification.

C. Sleeves

1. Provide sleeves for raceways, conduit and wire/cables passing through the following construction elements:

a. Concrete and masonry foundations, floors, walls and slabs.
b. Gypsum, Lath, and plaster walls and ceilings.

c. Building structures (i.e., foundations, walls, floors, ceilings, beams, and roofs) with a fire rating exceeding 20-minutes.

2. Sleeves shall extend 1.5-inch above and below floors, except under floor standing electrical equipment. Sleeves shall be flush with wall ceiling foundations and partitions exposed to public view and extend approximately 0.5-inch past penetration in fire rated construction. Sleeves shall be installed at exact penetration locations and angles to accommodate wire/cable, raceway and conduit routings.
3. Joists, girders, beams, columns or reinforcing steel shall not be cut or weakened. Where construction necessitates the routing of conduit or raceways through structural members, framing or footings, written permission to make such installation shall first be obtained from the District's Representative. Such permission will not be granted, however, if any other method of installation is possible.
4. The layout and design of raceways and conduits located in or routed through masonry or reinforced beams or the District's Representative shall review walls before any work is performed. All sleeving shall be accomplished according to the instructions of the District's Representative and shall be accepted before any concrete is poured.
5. Sleeves, raceways and conduit shall be located to clear steel reinforcing bars in beams. Reinforcing bars in walls shall be offset to clear piping and sleeves.
6. Provide a continuous clearance between the inside of a sleeve and exterior of wire/ cables, conduits and raceways passing through the sleeve not less than the following:

   a. 0.5-inch clearance except as required otherwise.
   b. 1.0-inch clearance through outside walls below grade.
   c. 3.0-inch clearance through seismic joints.

7. Sleeves set in fire rated construction shall be caulked between sleeve and building structure, additionally sleeves shall be caulked between the sleeve and the wire/cables, conduits/raceways passing through the sleeve. The caulking shall be a fireproof sealant, equal to the fire rating and temperature being penetrated. Clearance between components inside of sleeve and exterior of components passing through sleeve and between components inside the sleeve shall comply with Fire-proof Sealant Manufacturer's recommendations.
8. Sleeve material:

   a. In floor construction: Schedule 40 black steel pipe, with upper surface to be sealed watertight.
   b. In concrete or masonry walls roofs or ceilings: Schedule 40 black steel pipe. When installed in roofs or outside walls, seal outer surface watertight.
   c. In fire rated construction; 24 gauge galvanized iron or steel.
   d. Sleeves through waterproof membranes: Cast iron or Schedule 40 steel with flashing clamp device and corrosion resistant clamping bolts. Caulk space between pipe and sleeve and surfaces between sleeve and conduits sealed watertight.

3.2 GROUNDING

A. Grounding shall be executed in accordance with all Applicable Codes and Regulations, both of the State and Local Authorities Having Jurisdiction.

B. Where nonmetallic conduit is used in the distribution system, the Contractor shall install the proper sized copper ground wire in the conduit with the feeder for use as an equipment ground. The electrical metallic raceway system shall be grounded to this ground wire.

C. The maximum ground/bond resistance to the grounding electrode shall not exceed 1 ohms from any location in the electrical system. The maximum ground resistance of the grounding electrode to earth shall not exceed 5 ohms.

D. Ground/Bond Conductors

1. Provide an additional, dedicated, green insulation equipment ground/bond wire inside each conduit type and raceway as follows. Size the ground/bond conductors to comply with CEC/NEC Requirements. The metal conduit or raceway shall not be permitted to serve (function) as the only (exclusive) electrical ground return path:

   a. All types of nonmetallic conduit and all types of non-metallic raceways including but not limited to: RNMC – Rigid Nonmetallic Conduit.
   b. FMC - Flexible Metal Conduit.
   c. LTFMC - Liquid Tight Flexible Metal Conduit.
   d. Metal and non-metal raceways.
   e. RMC - Rigid Metal Conduit.
   f. EMT - Electrical Metal Tubing.

2. The equipment ground/bond wire shall be continuous from the electrical circuit source point of origin to the electrical circuit end termination utilization point as follows:

   a. Every conduit and raceway path containing any length of the above identified conduits or raceway.
   b. Every conduit path and raceway path connected to any length of the above-identified conduits and raceways.

3. The equipment ground/bond wire shall be sized as follows, but in no case smaller than indicated on the Drawings. Install equipment ground/bond wire in each conduit/ raceway, with the respective phase conductors:

   a.

Feeder, Subfeeders & Branch Circuit Protection	Min. Equip. Ground Wire Size
15 amp	#12
20 amp	#12
30 to 60 amp	#10
70 to 100 amp	#8
101 to 200 amp	#6
201 to 400 amp	#2
401 to 600 amp	#1
801 to 1000 amp	2/0
1001 to 1200 amp	3/0
1201 to 1600 amp	4/0
1601 to 2000 amp	250 MCM
2001 to 2500 amp	350 MCM
2501 to 4000 amp	500 MCM

4. Isolated grounds - Raceways containing branch circuit or feeder phase conductors connected to panelboards equipment, or receptacles with isolated grounds or isolated ground bus shall contain a dedicated insulated ground conductor connected to the isolated ground system only. The isolated ground conductor shall be continuous the length of the raceways and connected only to the isolated ground terminals in addition to and independent of the equipment bonding/ground conductor. The isolated ground conductor shall be sized as indicated above, for equipment ground/bond wire.

5. Splices in ground/bond wires shall be permitted only at the following locations:

   a. Ground buses with listed and approved ground lugs.
   b. Where exothermic welded ground/bond wire splices are provided.

6. Provide ground/bond wire jumpers for conduit fittings with ground lugs, expansion and deflection conduit fittings at conduit fittings connecting between metallic and non-metallic raceways and to bond metal enclosures to conduit fittings with ground lugs.

E. Where conductors are run in parallel in multiple raceways, the grounding conductor shall be run in parallel. Each parallel equipment-grounding conductor shall be sized on the basis of the ampere rating of the over-current device protecting the circuit conductors in the raceway. When conductors are adjusted in size to compensate for voltage drop, grounding conductors, where required, shall be adjusted proportionately in size.

F. Ground conductors for branch circuit wiring shall be attached at each outlet to the back of the box using drilled and tapped holes and washer head screws, 6-32 or larger.

G. Each panelboard, switchboard, pull box or any other enclosure in which several ground wires are terminated shall be equipped with a ground bus secured to the interior of the enclosure. The bus shall have a separate lug for each ground conductor. No more than one conductor shall be installed per lug.

H. UFER Ground

1. In addition to all cold water and structural steel grounds provided to meet this Specification, there shall be a main ground system of the UFER ground style.
2. The UFER ground electrodes shall be a minimum of two 20-feet lengths of #4/0 AWG bare stranded copper cable embedded horizontally in the cast in place concrete footing, extending in opposite directions in the footings. All portions of the ground electrodes shall be placed inside the concrete, between 2-inches and 4-inches from the earth surrounding the concrete.
3. The lengths of cable shall extend in opposite directions in the footings, with the center end of each cable terminated onto the main electrical service ground bus for the main electrical service equipment.
4. All wire cable connection terminations onto the ground bus shall be exothermic weld type.
5. The “UFER” grounding electrode, embedded in concrete, shall be exothermically welded to each steel reinforcing bar (rebar) and each steel anchor bolt located within 18-inches of the grounding electrode inside the concrete. Note: Reinforcing steel (rebar), in concrete foundations, attached with metal “tie-wraps” and in direct physical contact to other adjacent rebar that is in turn exothermic welded to the UFER grounding electrode, may be classified as attached to the UFER grounding electrode, and does not require additional exothermic weld connections to the UFER grounding electrode.

I. Provide a separate ground/bond insulated grounding electrode conductor, copper wire from the main electrical service ground bus to each of the following locations. The ground/bond conductor shall be sized to comply with applicable Codes and as indicated on the Drawings, but in no case smaller than the following:

1. Main service entrance equipment ground bus:

   a. Services smaller than 1200 amp 1.5-inch conduit with 1#4/0.
   b. Services 1200 amp and larger 2.5-inches conduit with 1#500MCM.
   c. Where a separate ground bus is not required, connect ground to electrical equipment metal housing

2. Each telephone backboard and signal system backboard location, 1.25-inch conduit with 1#1.
3. Metal cold water pipe located inside the building, 1.5-inch conduit with 1#4/0.
4. Outdoor underground metal cold water pipe, make connection five feet from the building, 1.5-inch conduit with 1#4/0.
5. Each service entrance ground bus and each separately derived ground rod system:

    a. Services smaller than 1200 amp 1.5-inch conduit with 1#4/0.
    b. Services 1200 amp and larger 2.5-inches conduit with 1#500MCM.

6. Separate 1.25 inch conduit with 1#2 (AWG) bonding conductor to each interior metal pipe system located in the same building, including but not limited to, the following:

    a. Fire sprinkler system each stand-pipe location (water based and non-water based).
    b. HVAC chilled water supply and return, at each pump location.
    c. Roof drains.
    d. Waste liquid disposal systems.
    e. Metal gas pipe service entrance and service meters.
    f. Hydraulic elevator hydraulic pipes.

3.3 CONDUIT

A. General

1. The sizes of the conduits for the various circuits shall be as indicated on the Drawings, but not less than the conduit size required by code for the size and quantity of conductors to be installed in the conduit.
2. Conduits shall be installed concealed from view. Install conduits concealed in walls, concealed below floors and concealed above ceilings, except as specifically noted otherwise.

    a. Conduits shall not be installed in concrete floors.

3. The following systems shall be considered as circuits 100 volts and less, all other circuits shall be considered to be over 100-volts (power circuits) unless specifically noted otherwise: Fire alarm, energy management control, telephone, public address, data, computer, television, intercom, intrusion alarm and nurse call.
4. Conduits shall be provided complete with conduit bends, conduit fittings, outlet boxes, pullboxes, junction boxes, conduit anchors/supports, grounding/bonding for a complete and operating conductor/ wire raceway system.
5. Metal and nonmetal conduits shall be provided mechanically continuous between termination connection points. Metal conduit shall be provided electrically continuous between termination connection points.
6. Individual conduit paths and home runs shown on the Drawings shall be maintained as separate individual conduits for each homerun and path.
7. Conduits, conduit fittings and installation work occurring in classified hazardous materials locations shall comply with applicable Code Class 1 Division 1 Requirements, unless specifically noted otherwise.
8. Transitions between conduits constructed of different materials and occurring in above grade locations shall be allowed only at outlet boxes, junction boxes, pull boxes, and equipment enclosures unless specifically indicated otherwise. Provide outlet boxes and junction boxes.
9. Metal conduit terminating to nonmetal enclosures; terminating into metal enclosures with “concentric ring” knockouts; terminating into metal enclosures with knockout reducing washers, including but not limited to equipment housings, outlet boxes, junction boxes, pull boxes, cable trenches, manholes, shall be provided with a ground/ bonding lug integrated with the conduit termination conductor fitting

construction, by the Fitting Manufacturer. The lug shall provide for connection of a grounding/ bonding conductor (insulated or uninsulated). The grounding lug shall be located on the fitting, inside the termination enclosure.

10. The type of conduit, type of conduit fittings, and type of conduit supports and method of conduit installation shall be suitable for the conditions of use and conditions of location of installation based on the Manufacturer's recommendations; based on the applicable Codes and based on the Requirements of the Contract Documents.

B. RMC Installation Locations

RGS, IMC conduits and RGS, IMC fittings shall be installed in the following locations:

1. Embedded in floors, walls, ceilings, roofs, foundations, and footings constructed with concrete.
2. Embedded in walls and foundations constructed with brick and masonry.
3. Interior of buildings, within 9-feet of finish floor lines for exposed conduit locations.
4. Exterior of building for exposed conduit locations.
5. Damp or wet locations, exposed or concealed locations.
6. Exposed on roofs.
7. In hazardous materials areas and locations; below hazardous materials areas and locations; above hazardous materials areas and locations.
8. Exposed on utility service poles, for pole risers less than 9-feet above finish grade.
9. RMC conduit and RMC fittings may be installed in any location where EMT and FMC conduit is permitted to be installed.

C. PVC Coated RMC Installation Locations

PVC coated RMC conduit and PVC coated RMC fittings shall be installed in the following locations:

1. Underground conduit locations for elbows and bends with a radius of less than 36-times the conduit diameter.
2. Underground vertical risers extending above grade.
3. Entire length of underground conduits for the following circuits:

    a. Audio microphones
    b. Lighting dimming controls

4. Installed in contact with earth or corrosive materials.
5. Exposed in "cold" rooms and "refrigerated" rooms, rooms with a maintained temperature below 65 degrees Fahrenheit.

D. EMT Installation Locations

EMT conduit and EMT fittings may be installed in the following locations, for circuit conductors operating below 600 volts to ground; locations containing only "non-hazardous materials"; only dry locations:

1. Concealed in hollow non masonry/non-concrete, metal stud frame and wood stud frame walls and floors.
2. Concealed above ceilings.
3. Exposed inside interior enclosed crawl spaces.
4. Exposed interior locations placed 9-feet or higher above finished floors (except as described in paragraph below at lower heights).
5. Exposed on walls and ceilings (any height) in the following dedicated function areas, interior enclosed room locations:

    a. Indoor enclosed electrical equipment rooms and closets.

b. Indoor enclosed data and telecommunication terminal rooms and closets.
c. Indoor enclosed HVAC equipment rooms and closets.

6. Any location where FMC is described to be installed, except as the final connection to rotating or vibrating equipment.

E. FMC Installation Locations

FMC conduit and FMC fittings may be installed in the following locations for circuit conductors operating below 600 volts to ground; locations containing only "non-hazardous materials"; only dry, interior locations:

1. Concealed in hollow non-masonry metal stud frame and wood stud frame fully enclosed walls.
2. Concealed above fully enclosed ceiling spaces.
3. FMC conduit shall be installed in continuous lengths between termination points. FMC shall not be "spliced" or coupled directly to FMC or any other conduit type under any circumstance.
4. The maximum continuous length of FMC that shall be installed between termination end points is 15-feet. Circuits requiring continuous conduit lengths exceeding 15 feet between termination end points shall be installed using either RMC or EMT conduits. FMC lengths shorter than 16-inches are prohibited.
5. The minimum size FMC conduit shall be as shown on the Drawings but not be less than the following:

a. FMC lengths of 6-feet or less, minimum FMC conduit size shall be 0.50-inch.
b. FMC lengths exceeding 6-feet, minimum FMC conduit size shall be 1.0-inch.

F. LTFMC Installation Locations

LTFMC conduit and LTFMC fittings shall be installed in the following locations for circuit conductors operating below 600 volts to ground; locations containing only "non-hazardous materials":

1. Final electrical connection to vibrating or rotating equipment; control and monitoring devices mounted on vibrating and rotating equipment including the following. Minimum conduit length shall not be less than 24-inches:

a. Motor, engines, boilers, solenoids, and valves.
b. Fixed mounted "shop" (manufacturing) production equipment.
c. Fixed mounted food preparation equipment and "kitchen" equipment.

2. All locations where exposed flexible conduit connections are required, both indoor and outdoor.
3. Final connection to indoors electrical transformers. Minimum conduit length shall not be less than 24-inches; maximum conduit length shall not exceed 72-inches.
4. Do not install LTFMC located in environmental air plenums.

G. RNMC Installation Locations

RNMC conduit and RNMC fittings shall be installed in the following locations containing only "non-hazardous material":

1. Underground, concealed below earth grade, unless specifically noted or specified otherwise.
2. Exposed on utility service poles, for pole risers at 9-feet or higher above finish grade, Schedule 80 PVC only.
3. RNMC type "EB" conduit(s) shall be concrete encased along the entire length of the conduits for all installation locations.
4. Non-metal type raceways and RNMC type conduit shall not be installed inside buildings.

H. Combi-Duct Installation Locations

Combi-duct conduits shall be installed where shown on the Drawings. Combi-duct shall be installed underground (below grade) as follows:

1. Do not install exposed or inside buildings above grade.
2. Provide a 0.25-inch pull rope in each inner duct.
3. Radius and elbows shall be rigid non-metallic, PVC, Manufacturer factory fabricated, in lieu of PVC coated RMC conduit.
4. Inner ducts shall be supported by internal spacers inside the enclosing outer duct.
5. Provide end bell and three-hole "snug-plugs" at each entrance end of Combi-duct into pullboxes, manholes, equipment cabinets' stub-ups and Combi-duct terminations. Compression type "snug-plugs" shall provide watertight and airtight seal between inner and outer ducts and around future cables installed in inner duct.

I. Conduit Installation

1. Conduit Supports

a. Securely and rigidly support all raceways/conduits from the building structure. Raceways/ Conduits shall be supported independent of all piping, air ducts, equipment ceiling hanger wires, and suspended ceiling grid systems. Secure conduit to structural element by means of UL listed and approved hangers, fasteners, "C" channels and pipe clamps.

b. Provide conduit supports spaced along the length of the conduit as follows:

1) RMC and EMT conduit, maximum not to exceed 96-inches on center; within 24-inches of each conduit bend and conduit termination location.
2) FMC and LTFMC conduit, maximum not to exceed 24-inches on center; within 6-inches of each conduit bend and conduit termination location.

c. Suspended conduit methods:

1) Individual, suspended raceways/conduits separated by more than 12-inches from any other conduit and suspended from ceilings and roofs shall be supported as follows:

a) Conduits smaller than 1.5-inches by means of hanger rods or hanger wires.
b) Conduits 1.5-inches and larger by means of hanger rods.
c) The conduit shall attach to the hangers with pipe clamps.

2) Suspended raceways/conduits positioned within 24 inches of any other conduit shall be grouped and supported by hanger rods using trapeze type conduit support channels ("C" channels). Conduits shall individually attach to common channels side-by-side, with pipe clamps.

d. Non-suspended conduit methods:

1) Individual raceway/conduits placed against wall/ceiling/floors, placed inside hollow wall/ceiling construction or structure framing (i.e., "drywall" or plaster hollow wall construction), shall be secured by means of individual pipe clamps and fasteners attached to the framing studs or other structural members and the conduit/raceway.
2) Provide common "C" channel supports for all multiple raceway/conduits placed against vertical or horizontal surfaces and positioned within 24-inches of other raceways/ conduits. Attach channels to the framing studs or other structural members. Attach the conduits/raceway individually to common channels, side-by-side, with pipe clamps.

3) The use of toggle bolts is prohibited.

e. Conduit rising from floor for motor connection shall be independently supported if extending over 18-inch above floor. Support shall not be to a motor or ductwork, which may transmit vibrations.

f. Provide conduit anchoring, conduit support and conduit bracing systems conforming to Earthquake Requirements. The conduit support/anchoring system capacity shall include the weight of the conduits, conduit fittings, conduit supports and conductors/wires/cables installed in the conduits plus a 300% safety factor. Submit Shop-Drawing details showing each typical conduit anchor, conduit support and conduit brace location. Submit structural calculations performed by and signed by a Professional Structural Engineer (P.E.) with a P.E. License, Registered in the State of California, U.S.A.

2. Conduit separation:

a. Conduit installed underground or below building slab without full concrete encasement: Shall be separated from adjacent conduits of identical systems (i.e. signal to signal, data to data, power to power, control to control etc.) by a minimum of 3-inches. Conduits of non-identical systems (i.e. signal to power; data to power; power to control; signal to control, etc.) shall be separated by a minimum of 12-inches.

b. Conduit installed underground with full concrete encasement; shall be separated from adjacent conduits of similar systems (100 volt and less) by a minimum of 2-inches; conduits for non-power systems (100 volts and less to ground) shall be separated by a minimum of 6-inches from power circuits (over 100 volts to ground); conduits for power circuits shall be separated from adjacent conduits of similar power systems (over 100 volts to ground) by a minimum of 3-inches.

c. Separation of conduits entering termination points or crossing other conduits may be reduced as required within 60-inches of the termination or crossing points.

d. Conduits containing Utility Company service circuits (i.e. electrical power, telephone, or cable television) shall be separated a minimum of 12-inches from all other utilities and conduits, with or without concrete encasement; metallic or non-metallic conduit, above grade or underground conduit locations.

e. Conduits shall be separated from hot water piping, exhaust flues/chimneys, steam piping, boilers, furnaces, ovens by a minimum of 12-inches.

3. Conduit stubs:

a. Branch circuit and telephone conduits turned up from floor at the following locations shall terminate each conduit in a flush conduit coupling at the floor and then extend into partition or to equipment. Refer to District's Representative's Drawings for location of walls and partitions.

1) Interior demountable partitions.
2) Below, into or adjacent to equipment not installed directly adjoining to a wall.
3) Up from below the floor into hollow stud frame walls.

b. From each panel, and signal cabinet which is wall mounted, stub up from top of the panel/ cabinet a minimum of three 1-inch conduits to the nearest accessible ceiling spaces or other accessible location. Where the floor below the panel is accessible or is a ceiling space, stub an additional three 1-inch conduits from the bottom of the panel into the accessible space below the panel. Cap conduits for future use.

c. Conduits stubbed underground outside of building line for future use shall be terminated a minimum of 5-feet clear (whichever distance is greater) of building or adjacent concrete walks and AC paving. The stubout conduit shall be capped. Provide concrete monuments, 6-inches by

6-inches by 15-inches deep, buried flush with grade over the capped ends. The face of monument shall be furnished with 3-inch square brass plates securely mounted and engraved with the number and size of conduits and type of service (i.e., "POWER", "TEL.", etc.).

d. Conduits stubbed into ceiling or floor spaces from outlets for telephone, video, computer/data or television shall be provided with an insulated throat bushing, on the end of each conduit stubout.
e. Conduit stubouts from outlet boxes and equipment located in hollow stud walls, into ceiling and floor spaces, shall be EMT or RMC conduit. The stubouts shall terminate into the ceiling and floor spaces with a conduit termination connector fitting.
f. Empty conduit stubs into building spaces and equipment shall be individually identified with an "ID-tag" located at each end of the conduit. The ID-tag shall state the origination point and termination point of the respective conduit (i.e., "from PNL-A/to Room #121"; "from outlet #24/to outlet #17 in Room #120"; etc.).
g. Provide a conduit termination fitting with insulated throat bushing and mechanical ground lugs at each conduit "stub-up" location.

4. Conduit concrete encasement:

a. Conduits which are run underground exterior to building slab shall be continuously concrete encased except, 15-amp and 20-amp power branch circuit conduits underground do not require concrete encasement.
b. PVC rigid-non-metallic-type EB conduit, of any size and any location shall be continuously concrete encased the full length of the conduit installation, including under building slab.
c. Concrete for encasement of underground conduits shall be 2000-PSI 28-days cure strength with a mix of cement, sand, water and maximum of ¾-inch gravel. Concrete encasement of conduits shall be continuous without voids. The encasement shall extend 3-inches past the edges of all conduits on all sides of the circuit. Provide 10-pounds of red oxide cement coloring uniformly mixed with each cubic yard of concrete for conduit encasement.
d. Conduits located below or adjacent to structural foundations shall be separated from the foundation by a minimum of 12-inches. Conduits located below structural foundations shall be fully and continuously concrete backfilled and encased between the bottom of the foundation to the bottom of the conduits. The concrete shall be 4000 PSI 28 day cure strength instead of 2000-PSI concrete.
e. Conduits of any size and type (including 15-amp and 20-amp power branch circuits) located under roads, paved areas and "transit-system" right of way shall be concrete encased.

5. Underground conduits:

a. Three or more underground conduits larger than 1-inch in size and occupying the same trench shall be separated and supported on factory fabricated, non-metallic, duct/conduit support spacers. The spacers shall be modular, keyed interlocking type, "built-up" to accommodate quantity, size orientation and spacing of installed conduits.
The spacers shall maintain a constant distance between adjacent conduit supports and hold conduits in place during trench backfill operations. Minimum support spacer installation interval along with length of the conduits shall be as follows:

1) Concrete encased conduits, not less than 8-feet on center.
2) Non-concrete encased conduits, not less than 5-feet on center.

b. Provide trenching, excavation, shoring and Backfilling required for the proper installation of underground conduits. Tops of backfill shall match finish grade.
c. Bottoms of trenches shall be cut parallel to "finish grade" elevation. Make trenches 12-inches wider than the greatest diameter of the conduit.

d. Back-filling Trenches for Conduits without Concrete Encasement Requirements

1) Conduits which are not required by the Contract Documents to be concrete encased and are located exterior to building slab, shall be set on a 3-inch bed of damp clean sand. Conduit trenches shall be backfilled to within 12-inches of finished grade with damp sand after installation of conduit is completed. Remainder of backfill shall be native soil.
2) Conduits located under a building which are not required by the Contract Documents to be concrete encased, shall be completely backfilled and compacted with clean damp sand to the same level as the building foundation pad.
3) Provide a continuous yellow 12-inches wide flat plastic tracer tape, located 12-inches above the conduits in the trench. The tracer tape shall be imprinted with "Warning-Electric Circuits" a minimum of 24-inches on center.

e. Backfilling trenches for conduits under paved areas:

1) In addition to the Requirements of conduit concrete encasement, conduits under walkways, roads, parking lots, driveways, and buildings shall be cast in place concrete "slurry mix" backfill. The slurry mix shall cover each side and top of conduits and conduit concrete encasement. The slurry mix shall be continuous to the underside of the finish subgrade surface.

f. Backfilling trenches for conduits with Concrete Encasement Requirements by the Contract Documents:

1) Trenches with all conduits concrete encased shall be backfilled with clean damp sand when located under building pads.
2) Trenches with all conduits concrete encased and not located under a building pad and not located under paved areas shall be backfilled with clean damp sand or native soil.

g. Backfill material:

1) Sand and native soil backfill of trenches shall be machine vibrated in 6-inch lifts to provide not less than 90% compaction of backfill.
2) Soil backfill shall have no stones, organic matter of aggregate greater than 3-inches.
3) Concrete and slurry mix (2000-PSI) shall be machine vibrated during installation to remove "air-voids".
4) The slurry mix shall consist of concrete, clean rock, clean sand and clean water mixture. Maximum shrinking of slurry mix shall not exceed 5% wet to dry.

h. Do not backfill until District's Representative has approved Installation and As-built Drawings are up to date. Promptly install conduits after excavation has been done, so as to keep the excavations open as short a time as possible. Excess soil from trenching shall be removed from the site.

i. Install underground conduit, except under buildings, not less than 24-inches below finished grade in non-traffic areas and 30-inches below finished grade in traffic areas, including roads and parking areas. Not less than 48-inches below finished grade under public/private transit system right of way and railroad right of way. Dimensions shall be measured to the top of the conduit.

j. Conduit crossing existing underground utilities shall cross below the bottom depth of the existing utilities. If the top portion of the existing utility depth below finish grade exceeds 72-inches and

the specified separation and depths are maintained when crossing over the top of the existing underground utility, the conduit may cross above the existing underground utility.

k. Provide long radius horizontal bends (minimum radius of 36-times the conduit diameter) in underground conduits where the conduit is in excess of 100-feet long.

l. Conduits installed below grade and on grade below buildings, shall not be smaller than 0.75-inches. Conduits for circuits exceeding 600-volts shall not be smaller than 5.0-inches.

m. Underground conduits entering a building shall be sloped. The conduit direction of slope shall be away from the building, and shall prevent water in the conduit from "gravity draining" towards the building. The conduit slope "high point" shall originate from the building, out to the first exterior pullbox, manhole etc. exterior conduit termination "low point". The minimum slope angle shall be a constant 8-inches (or greater) of fall for each 100-feet of conduit length.

n. Dewatering:

1) Provide pumping to remove, maintain and dispose of all water entering the excavation during the time the excavation is being prepared, for the conduit laying, during the laying of the conduit, and until the backfill at the conduit zone has been completed. These provisions shall apply on a continuous basis. Water shall be disposed of in a manner to prevent damage to adjacent property. Trench water shall not be drained through the construction. Groundwater shall not be allowed to rise around the pipe until joining compound has firmly set.

2) The District's Representative shall be notified 48 hours prior to commencement of dewatering.

6. Raceway/Conduits, which are installed at this time and left empty for future use, shall have 0.25-inch diameter polyvinyl rope left in place for future use. The pull rope shall be 500-pound minimum tensile strength. Provide a minimum of 5-feet of slack at each end of pull ropes.

7. Unless otherwise restricted by Structural Drawings and Specifications, the maximum size conduit permitted in concrete slab on-grade, walls, ceilings and roofs constructed of masonry or concrete shall not be greater than 20% of the concrete/masonry thickness. Conduits installed in these locations shall not cross.

a. Conduits shall not be installed in cast-in-place concrete floors.

8. Provide openings in building structures for conduit penetrations:

a. New construction shall be provided with conduit sleeves, to provide conduit penetrations.

b. Existing construction shall be drilled (core drill masonry and concrete) and provide conduit sleeves installed after drilling, to provide conduit penetrations.

c. Where the structure penetrations for underground conduits penetrating through foundations will not comply with the (restriction/penetration) shown in the Contract Documents, install the conduits below and clear of the foundation lowest point.

9. Conduit bends risers and offsets:

a. The minimum bend radius of "factory or field" fabricated conduit bends shall not be less than the following. The bend radius shall be measured at the surface, inside radius of the conduit wall:

1) FMC and LTFMC conduit - conduit minimum bend radius 12-times the conduit dia-meter.

2) RMC and EMT conduit minimum bend radius – conduit for power circuits over 100 volts and less than 600 volts, 8-times conduit diameter. Conduit for power circuits over 600 volt, 12-times conduit diameter. Conduit for low voltage, signal and fiber optic circuits, 10-times conduit diameter.

3) RNMC conduit - conduit minimum bend radius 36-times the conduit diameter. Under building reduce minimum bend radius to 10-times the conduit diameter. Conduit bends and offsets in RNMC with less than 36-times conduit diameter bend/offset radius shall be RNMC PVC Schedule 80 or PVC coated RGS.
4) Conduits for Utility Company conductors. Conduit minimum bend radius shall comply with the respective Utility Company Requirements.

b. Bends and offsets in conduits shall be kept to an absolute minimum. The total summation of all bends and offsets permitted in a conduit segment, occurring between two conduit termination/ connection end points, shall not exceed the following, including conduit fittings:

1) RMC and EMT conduit – 360 angular degrees
2) FMC and LTFMC conduit – 180 angular degrees
3) RNMC conduit – 270 angular degrees

c. Each field fabricated conduit offset, bend and elbow which are not the standard product of the Raceway/Conduit Manufacturer shall be mandrel tested. The test shall be conducted after the conduit installation is complete and prior to pulling-in any wire, in the same manner as for underground conduits.
d. Factory manufactured angle connector conduit fittings shall be installed in exposed conduit locations only. Installation in locations normally concealed from view shall not be permitted. Not more than one factory manufactured angle connector shall be permitted in any length of conduit between conduit termination end points.
e. RNMC conduit risers from below grade shall be PVC coated RGS. Conduit risers, bends or offsets entering into a building shall be PVC coated RGS.

f. If three or more conduit-bends of the same conduit size and same conduit material type, installed, as part of the Contract Work, fail to comply with the required minimum conduit bend radius or conduit angular degree limits. The following corrective actions shall occur:

1) The Contractor shall remove all the non-complying conduit bends and the respective wire in the conduit from the project site. Provide new conduit and wire, complying with the Contract Documents.
2) Where the conduit bends similar to the non-complying conduit bends are installed concealed in walls, floors, above ceilings or below grade, the Contractor shall expose the conduit bends to allow visual observation.
3) The Contractor shall remove the non-complying conduit bends and dispose of the Project Site. The Contractor shall provide new conduit bends and conductors complying with the Contract Documents.
4) All the costs to correct the deficient material and work along with costs to repair the direct, indirect, incidental damages and Contract delays shall be the sole responsibility of the Contractor and shall be included in the bid price.

10. Expansion joint, deflection joint and seismic joint fittings.

a. Provide a conduit expansion fitting for each conduit length and conduit type as follows (Note - The installation of specified combination expansion/deflection fittings at seismic joints shall satisfy this Spacing Requirement also):

Conduit Type	Conduit	Fitting Length Spacing

1)	RMC and EMT	Exposed exterior locations	200-feet
2)	RMC and EMT	Interior weather protected locations	200 feet

b. Provide a conduit combination expansion/deflection fitting for each conduit, crossing the following elements:

1) At each building or non-building structure seismic joint.
2) At each building on non-building structure expansion joint.
3) At each conduit penetration of a "sound-rated" wall, floor or ceiling.

11. Provide two locknuts and an insulated throat bushing at each metal conduit terminating at enclosures, including but not limited to outlet boxes, junction boxes, terminal cabinets, switchgear, transformers, switchboards, distribution panels and panelboards.
12. Provide metallic or plastic closure caps on all conduit ends during construction, until installation of conductors in the respective conduit.
13. Conduit run exposed, shall be run at right angles or parallel to the walls or structures. All changes in directions, either horizontally or vertically, shall be made with conduit outlet bodies as manufactured by Crouse Hinds, OZ or equal. Conduits run on exposed beams or trelliswork shall be painted to match surrounding surfaces.
14. Conduit exposed on roof:

a. Conduits installed exposed on roofs shall be installed on conduit sleepers. Place the conduit sleepers a maximum 5-foot on center along the entire length of the conduit; under conduit expansion/deflection fittings; under each junction box and within 24-inches of each conduit bend.
b. Provide a conduit support "C" channel continuous along the top length of the sleeper and rigidly bolted to the sleeper. Conduits shall be loosely fastened to each sleeper "C" channel with pipe clamps to allow for relative movement between the sleeper and conduit.
c. Conduits shall not block or interfere with roof hatches, doors, ventilation openings, dampers, equipment access panels/doors, roof water drainage.
d. Conduit sleepers shall be fabricated from "clear" solid redwood 4-inches by 4-inches (nominal) size. Sleeper length shall extend a minimum of 9-inches past the conduits attached to the sleeper, but in no case shall the length of the sleeper be less than 24-inches.
e. Provide a pad under each sleeper; sleepers shall not be installed in direct contact with the roofing. Sleeper pads shall extend a minimum of 6 inches past each side of the sleeper. The sleeper pad shall be semi-rigid mineral surfaced composition board, not less than 0.375-inch thickness, bituminous impregnated, manufactured for application on the specific roofing material. Remove roofing "ballast" (gravel) under pad, prior to installation of sleeper pad. Do not puncture roof membrane.
f. Position the "length" of the conduit sleepers' perpendicular to the roof slope, to prevent obstruction of roof drainage water flow. Where the conduit routing prevents placing the conduit sleeper parallel to the roof slope, provide two separate sleeper pads for the conduit sleeper, with a continuous 3-inches wide water drainage gap between the sleepers. Align the water drainage gap to allow unimpeded water travel along the roof slope drainage flow line between the pads.
g. Sleepers and sleeper pads shall be set in nonhardening mastic, a minimum of 0.25-inch thickness. Mastic shall be inorganic, nonhardening, and complying with ASTM-D1227. Mastic shall be applied with continuous uniform coverage, minimum 0.25-inch thickness, on all the surfaces of each conduit sleeper and on the sleeper pad contact surface with the roof.

15. Rigid steel conduit or electrical metallic tubing shall not be strapped or fastened to equipment subject to vibration or mounted on shock absorbing bases.
16. RMC conduit threads:

a. Machine cut threads on RMC conduit required for field fabrication shall comply with NPS and ANSI-B1.20.1.
b. The length of bare metal exposed during thread fabrication shall be completely covered by conduit couplings and fittings. Additionally, the thread length shall insure that conduit joints will reach "torque" tightness and become secure before conduit ends "butt" together and before conduit ends "butt" into the "shoulders" of other conduit fittings.
c. Running threads or right/left handed threads shall not be used to connect RMC.

17. RNMC conduit:

a. Joints and fittings shall be solvent welded to RNMC conduit. Joints and fittings shall be watertight and airtight after fabrication.

18. Tighten each conduit fittings and fitting appurtenance, to the "torque" (allowable tolerance ±5%) value recommended by the Fitting Manufacturer and applicable Code. If three or more conduit fittings are found to not be in compliance with the Manufacturer's "torque" (tightness) recommendations, the following corrective actions shall occur:

a. The Contractor shall tighten "re-torque" the defective fittings and all similar conduit fittings installed as part of the Contract Documents in the presence of the District's Representative.
b. If the respective conduit fittings similar to the deficient "torque tightness" fittings are installed concealed in walls, floors, above ceilings or below grade, the Contractor shall expose the fitting, to allow retightening each similar conduit fitting to the Manufacturers recommended "torque" values.
c. All the cost to repair the direct, indirect, incidental damages and Contract delays resulting from complying with these Requirements shall be the sole responsibility of the Contractor and shall be included in the bid price.

19. Horizontal directional boring for underground conduit:

a. Provide a directional guided horizontal "bore-hole" underground conduit installation where one or more of the following conduits occur:

1) Continuous trenching excavation and backfill for conduit installation is not permitted by the Contract.
2) Where continuous trenching excavation due to the existing surface and below grade conditions and restrictions, is not possible or practical to excavate a trench.

b. Provide "path-tracing" of the underground bore head, from the surface, along the entire horizontal bore length. Path tracing shall use electronic transmitters and receivers, continuously communicating the underground bore head locations and depth to the bore equipment operator. The directional boring system shall employ active tracking and directional position/steering control of the bore equipment drill head location. The active tracking system shall provide a portable receiver/transmitter unit for tracking the position of the moving drill head; a sensor "Sonde" unit on the drill head for tracking signals to the receiver/transmitter; and a drill head tracking data view display located at the boring equipment operator position to view the drill head position information sent from the portable receiver/transmitter. As manufactured by SPX-Radiodetection Company or similar products.
c. Provide vertical pilot excavations not more than 50-feet on center along the path of the bore-hole to intercept the horizontal bore-hole routing, provide excavations at the beginning and end terminals staging points of the horizontal bore-hole.
d. Provide full-depth "shoring" of the vertical pilot excavations. Remove the shoring, backfill, compact and repair the excavations when conduit installation is complete.

e. "Drilling-fluid" shall be used during "back-reaming" and "pullback", pumped through the drill pipe to the bore drill head.
f. Directional guided horizontal drilling shall employ equipment specifically designed and manufactured for the process. The Equipment Manufacturer shall train bore equipment operating personal in the proper operation of said equipment.
g. Locate the position, size, depth and identify all underground "cross-bore" existing underground utilities, pipes, structures and conflicts along the entire bore path of each underground bore, prior to initiating directional boring work. Notify respective agency for each "cross bore" potential crossing. Comply with the recommendations of the Cross Bore Safety Association (CBSA).
h. Horizontal, directionally guided boring equipment, as manufactured by Ditch Witch; Vermeer Manufacturing; or Case Corporation.

J. Conduit Seals

1. Provide conduit seal fittings at each location where a conduit transitions or passes through the following areas and where indicated on the Drawings:

   a. Refrigerated areas.
   b. Temperature control rooms including warming rooms, steam rooms, saunas etc.
   c. Classified hazardous material areas.
   d. Water intrusion areas.

2. Provide conduit seals on each conduit entering a building from a below grade area located outside the building (i.e., basement, vault etc.) and connecting to the following types of equipment

   a. Transformers
   b. Panelboards
   c. Motor control centers
   d. Switchboards
   e. Switchgear
   f. Motors
   g. Terminal cabinets
   h. Terminal backboards
   i. Cable trenches

3. Conduit seals shall be installed in locations where the fitting is visible and accessible.

K. Nailing Shields

1. Provide "nail" shields where FMC conduit and conductors not installed in a conduit are installed through wood stud and wood frame construction. The nail shield shall provide a barrier resistant to "nailing" fasteners through the stud, and penetrating into the FMC and conductors.
2. The nail shields shall be flat nominal 1.5-inch by 3-inches, 14-gauge steel, and hot dip zinc galvanized with "nailing spurs".
3. Provide nailing shields on the front face and rear face of each FMC penetration. The shield shall be centered on each penetration through the respective framing, stud framing blocking, and stud framing plates.

L. Conduit Bodies

1. Conduit bodies shall be installed in exposed conduit locations only or above accessible ceilings.
2. Conduit bodies shall be accessible for removing body cover and pulling wire through the conduit body.

3. Conduit bodies shall not be installed inside enclosed walls.

M. Preparation of Reuse of Existing Conduits

1. Prepare existing conduits shown to be reused as part of Contract Work as follows: Complete the required work prior to installing any conductors or cables in respective existing conduits.

   a. "Rod" out existing raceways to be used under this contact, with approved test and flexible mandrels to remove all obstructions to clear debris from inside conduits.
   b. Use test mandrels at least 12-inches long, 0.25-inch less than diameter of duct at center, tapering to 0.5-inch less than duct size at ends.

2. If test mandrels cannot be pulled through raceways, Contractor shall perform the following to clear the existing raceways:

   a. Force rigid or semi-rigid rods through the raceways to clear the obstructions from one to both ends of the raceway.
   b. Force a power driven rotating router device through the conduit from one or both ends of raceways. Device shall incorporate small diameter cutting blades. Repeat the "router" process in incremental stages to a cutting blade diameter approximately ⅛-inch smaller than the race-way inside diameter.

3. After clearing the raceway of obstructions, pull a test mandrel or brush through the raceway to clear the remaining debris from the raceway.

3.4 WIRE AND CABLE

A. Branch circuit and fixture joints for #10AWG and smaller wire shall be made with UL-approved connectors listed for 600 volts, approved for use with copper and/or aluminum wire. Connector to consist of a cone-shaped, expandable coil spring insert, insulated with a nylon shell and two wings placed opposite each other to serve as a built-in wrench or shall be molded one-piece as manufactured by 3M-"Scotchlok".

B. Branch circuit joints of #8AWG and larger shall be made with screw pressure connectors made of high strength structural aluminum alloy and UL-approved for use with both copper and/or aluminum wire as manufactured by Thomas & Betts. Joints shall be insulated with plastic splicing tape, tapered half-lapped and at least the thickness equivalent to 1.5-times the conductor insulation. Tapes shall be fresh and of quality equal to Scotch.

C. Use UL listed pulling compound for installation of conductors in conduits.

D. Correspond each circuit to the branch number indicated on the panel schedule shown on the Drawings except where departures are approved by the District's Representative.

E. All wiring, including low voltage, shall be installed in conduit.

F. Control wiring to conform to the wiring diagrams shown on the Mechanical Drawings and the Manufacturer's Wiring Diagrams.

G. All splices in exterior pull boxes and light poles shall be cast resins encapsulated.

1. Power conductor splices - 3M Scotchcast Series 82/85/90; Plymouth or equal.
2. Control and signal circuits 3M Scotchcast Series 8981 through 8986, Plymouth or equal.

H. Neatly group and lace all wiring in panelboards, motor control centers and terminal cabinets with plastic ties at 3-inch on centers. Tag all spare conductors.

3.5 CHEMICAL GROUND ROD

A. General

1. Install ground rod system in compliance with Manufacturer's instructions.
2. Install rods vertically. Where subterranean hard rock conditions prevent vertical installation horizontal "L" shape ground rod shall be installed.
3. Where ground rod is installed in an indoors dry location set ground box flush with finish floor. Where ground rod is installed outdoors set the top of the ground box four inches above finish grade.
4. Do not remove sealing tape from ground rod holes until time of installation in ground.
5. Separate ground rods from all other grounding electrodes and from each other by not less than 12-feet horizontal distance.

B. Excavation

1. Vertical installation bore a 12-inches diameter vertical hole in the ground six inches deeper than ground rod length.
2. Horizontal installations excavate a 12-inches wide trench, slope rod and trench to insure end cap of rod is 2-inches lower than the elbow.

C. Backfill

1. Surround the entire rod with a minimum of 10 inches of bentonite clay mixed with water at six times volume to form a paste. Approximately 14-gallons for each 50-pounds of clay. Remove any excavation liners from the rod excavation area.
2. Install ground box and complete backfill.

D. Connect grounding electrode conductor(s) to ground rod.

3.6 CABLE RACKS

A. General

Provide cable racks in precast and cast-in place concrete pullboxes, manholes and cable trenches.

3.7 TESTING

A. Testing Conduit and Conduit Bends

The Contractor shall demonstrate the usability of all underground raceways and field fabricated conduit bends installed as part of this Contract.

1. A round tapered segmented semi-rigid mandrel with a diameter approximately ¼-inch smaller than the diameter of the raceway, shall be pulled through each new raceway.
2. The mandrel shall be pulled through after the raceway installation is completed. Conduits which stubout only, may have the mandrel pulled after the concrete encasement is completed, but prior to completing the backfill.

3. District's Representative shall witness the raceway testing for usability. A Representative of the respective Utility Company shall witness the raceway testing where applicable.
4. Contractor shall repair/replace any conduit and conduit bend provided under this Contract which will not readily pass the mandrel during this test.

END OF SECTION 260530
040119/212227

SECTION 260543 – UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other Sections for work related to those other Sections and required to be included as work under this Section.
2. General Provisions and Requirements for electrical work.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Submit Product Data Sheets.

B. Submit Detailed Shop Drawings including Dimensioned Plans, Elevations, Details, Structural Calculations signed by a California State Registered Structural Engineer and descriptive literature for all component parts.

1.3 SECTION INCLUDES

A. Concrete Encased Ductbanks where indicated on Contract Drawings.

B. Trenching, Backfilling, Compacting, and Concrete Encasement for all 600V, 4.16kV and 12kV Ductbanks shall be required.

1.4 RELATED WORK SPECIFIED ELSEWHERE

A. Excavating and Backfilling for Utilities: Division 31.

B. Concrete: Division 03.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Duct, Fittings and Spacers:

1. Carlon, an Indian Head Co.
2. Queen City Plastics, Inc.
3. Robintech Inc.

4. R & G Sloane Manufacturing Co. Inc.
5. Allied Tube and Conduit.

2.2 MATERIAL AND FABRICATION

A. PVC Duct Schedule 40 (UL listed only): Manufactured in accord with NEMA Standard TC-2 and WC-1094 Specifications.

1. Cemented fittings.
2. Spacers: Vertical and horizontal interlocking duct spacers for concrete encasement: High-impact styrene.
3. Riser sweeps for power and communication ducts shall be rigid galvanized steel or Schedule 80 PVC.

B. Rigid Steel Conduit, Elbows and Nipples:

1. Threaded, hot-dipped galvanized conduit manufactured in accord with ANSI C80.1 and UL 6.
2. Threaded, hot-dipped galvanized fittings manufactured in accord with ANSI C80.4.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Excavate in Accord with Division 31.

B. Exercise Care in Excavating, Trenching, and Working near Existing Utilities.

C. Installation of Ductbanks:

1. Ductbanks for primary electrical power and communication systems shall consist of multiple, single, round bore ducts. Ducts shall consist of PVC Schedule 40 conduits, UL approved only. All fittings and couplings shall be of the same type and Manufacturer of the duct, with UL approval.
2. Galvanized steel conduits installed below grade shall be painted with two coats of Koppers bitumastic paint before installing in ground.
3. All conduit risers into switchgear pad, transformer pad, communication pull boxes or enclosures shall be galvanized steel and have a radius of 60-inches minimum, unless indicated otherwise on Drawings.
4. Concrete encased ductbank shall be completely encased in a minimum of 3 inches of concrete. Concrete shall be Class "B" red tint for 4.16kV and 12kV power and green tint for communication (6 lb. tint per cu. yd.), 2500 psi at 28 days. Ductbanks shall be of a monolithic construction top to bottom and side to side, but not necessarily end to end. All PVC duct shall be protected prior to installation.
5. Prefabricated, interlocking intermediate and base spacers for Schedule 40 PVC conduit shall be used made of Specification grade high-density polyethylene. Spacers shall be installed not more than 5 feet center-to-center along entire length of ductbank. Each conduit shall be supported by spacers.
6. At connection to manholes, dowel concrete encasement with one No. 4 reinforcing bar 36 inches long per duct.
7. Ductbanks shall be securely anchored to prevent movement during placement of concrete.
8. Where connection to bulkhead of ductbank is made to vaults or existing ductbanks, the concrete encasement shall be doweled with one No. 4 reinforcement rod 36 inches long per conduit to the existing encasement.

9. Ductbank trench shall be shored, framed and braced for installing ducts. Frames, forms, and braces shall be either wood or steel. Variations in outside dimensions of the completed ductbank shall not exceed 2 inches on the vertical or the horizontal from dimensions shown on Drawings. Remove all forms and bracing after 24 hours and before backfilling.
10. Do not place backfill for a period of at least 24 hours after pouring of concrete.
11. Ductbanks shall be laid to a minimum grade slope of 4 inches per 100 feet. This slope may be from one manhole to the next or both ways from a high point between manholes, depending upon the contour of the finished grade. See respective Profile Drawings.
12. Ductbanks shall be installed so that the top of the concrete encasement shall be not less than 48 inches below finished grade or pavement for primary 12 kV power, and not less than 36 inches below finished grade or pavement for 5 kV power.
13. Changes in direction of runs either vertical or horizontal shall be accomplished by long sweep bends having a minimum radius of curvature of 30 feet, except that manufactured long radius bends may be used in runs of 100 feet or less on approval from Owner.
14. Duct joints in concrete encasement may be placed side by side horizontally, but shall be staggered at least 6 inches vertically. All joints shall be made in accord with Manufacturer's recommendations for the particular type of duct and coupling selected. In the absence of specific recommendations, various types of duct joints shall be made by the following method:

    a. Plastic duct connections shall be made by brushing a plastic solvent cement on the inside of a plastic coupling fitting and on the outside of duct's ends. The duct and fitting shall then be slipped together with a quick one-quarter turn to set the joint.

15. The electrical system ground conductor shall be a minimum No. 4/0 AWG bare stranded copper cast in ductbank 3 inches below top of concrete, entering each manhole, and grounded to a rod using exothermic method as indicated on Drawings. The electrical system ground shall be connected to substations ground loops. A minimum of 15 feet pigtail shall be provided at each stub-up location noted on Drawings.
16. After the duct line has been completed, three each nonflexible mandrels not less than 12 inches long having a diameter approximately ¼-inch less than inside diameter of the duct shall be pulled through each duct; after which a brush with stiff bristles shall be pulled through each duct to make certain that no particles of earth, sand or gravel have been left in the line. Leave a 3/8-inch minimum polypropylene pull rope in each duct for future use.
17. Underground utilities marking: Install in accord with Division 31.

END OF SECTION 260543
040119/212227

BLANK PAGE

SECTION 260548 - SOUND CONTROL

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other Sections for work related to those other Sections and required to be included as work under this Section.
2. General Provisions and Requirements for electrical work.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Comply with pertinent provisions of Division 26.

B. Submit product data sheets for vibration isolation devices.

C. Submit detailed Shop Drawings including Dimensioned Plans, showing equipment vibration isolation anchoring.

PART 2 - PRODUCTS AND EXECUTION

2.1 QUIETNESS OF OPERATION

Before the work will be accepted as complete, quietness of operation, to a degrees satisfactory to the Architect shall be attained for apparatus, equipment, fixtures, etc., included under the electrical work. Provide isolation and vibration protection required.

2.2 VIBRATION ISOLATION FOR ELECTRICAL EQUIPMENT

A. Objective: It is the objective of this Specification to provide the necessary design for the avoidance of excessive noise or vibration in the building due to the operation of machinery or transformers, and/or due to interconnected conduit.

B. Contractor Responsibility

1. Provide a submittal to the Architect for review prior to any installation of his equipment, containing the following information:

a. Catalog cuts and data sheets on specific vibration isolators to be utilized showing compliance with the Specification.

b. An itemized list showing the items of equipment to be isolated, the isolator loading and deflection and isolator placement.
c. Drawings showing methods for attachment of conduit to motors.

2. Furnish and install the vibration isolation devices as specified herein.
3. Do not install any equipment or conduit as specified in the schedule, which makes rigid contact with the “building” unless it is approved in this Specification, or by the Architect. "Building" includes slabs, beams, studs, walls, lath, etc.
4. Coordinate work with other trades to avoid rigid contact between equipment or conduit as specified in the schedule and the building. Inform other trades following his work, such as plastering, to avoid any contact that would reduce the vibration isolation.
5. Bring to the Architect's attention, prior to installation, any conflicts with other trades which will result in unavoidable contact to the equipment or conduit as specified in the schedule, described herein due to adequate space, etc. Corrective work necessitated by conflicts after installation shall be at the responsible Contractor's expense.
6. Bring to the Architect's attention any discrepancies between the specifications and field conditions, changes required due to installation. Corrective work necessitated by discrepancies after installation shall be at the Contractor's expense.
7. Obtain approval from the Architect of any installation to be covered on enclosed, prior to such closure.
8. Obtain written and/or oral instructions from the vibration isolation manufacturer as to the proper installation and adjustment of vibration isolation devices.
9. Notify the Architect, prior to the general installation of vibration isolation devices, so that the Architect can instruct and demonstrate the technique of proper installation with the Contractor's Foreman.
10. Correct, at no additional cost, all installations, which are deemed to be defective workmanship or materials by the Architect.

2.3 VIBRATION ISOLATION TYPES

A. Isolator Description

1. Isolate all transformers with Type MN molded neoprene units equipped with leveling bolts and design status deflection under load of 0.3-inch.
2. Isolate all switchgear connected directly to transformer with Type PN isolators. Limit loading to a static deflection of 0.06 inch. Choose the area of pad to match the load with the Manufacturer's recommended unit loading. An auxiliary steel plate may be required to distribute the load uniformly over the pad area.

B. Equivalent Vibration Isolators

1.

Type Description	A	B	C	D	E	F	G
Neoprene Mount							
a) 0.2-inch max. deflection	N	FD	R	RV	CS	F	T-44
b) 0.4-inch max. deflection	ND	FDD	RD	RFD	FU	RD	T-44
PN Neoprene Pad	W	(1)	(2)	NR	R	(3)	100W

2. Notes
(1) Elastrogrip
(2) Shearflex
(3) Kinetic

Manufacturer’s Code
A. Mason Industries
B. Korfund
C. Vibration Mounting
D. Amber/Booth
E. Sausse
F. Consolidated Kinetics

G. Vibration Eliminator

2.4 CONDUIT INSTALLATION

A. Provide flexible conduit or an approved vibration isolation device between any transformer and the building structure.

B. Secure all electrical panels connected to transformers by flexible conduit to the floor. Do not contact stud or masonry partitions. Isolated panels from the floor as specified herein.

C. Provide flexible conduit connections to all connections to air conditioning, plumbing, etc., or any rotating or oscillating equipment requiring electrical motors. Base the length of flexible conduit required for each motor upon the Requirements for a 360 degrees loop in the conduit between the electrical motor and electrical box.

D. As an alternative to the 360 degrees loop, a Neoprene or rubber bushing between the conduit and the electric motor to break the metal-to-metal contact may be used. Provide a flexible ground strap to complete the electrical ground.

2.5 DEVICE OUTLET BOXES (INSTALLED IN COMMON PARTY SEPARATION WALLS, IN CORRIDOR WALLS AND SERVICE WALLS)

Device outlet boxes installed in walls shall be sealed on the exterior back and sides of the boxes, including wall openings around the box, with a ⅛-inch minimum thickness resilient sound absorbing, sealant. The sealant shall be free of asbestos, temperature rated from -30°F to 200°F, self-adhesive to metal and plastics, as manufactured by Lowry and Associates Inc. Sun Valley, California or equal.

END OF SECTION 260548
040119/212227

THIS PAGE IS BLANK

SECTION 260910 – SUPPLEMENTAL METERING AND SUB-METERING

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other Specification Sections and Drawings for related work required to be included as work under Division 26.
2. General Provisions and Requirements for electrical work.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Provide Schematic Control Wiring Diagrams and "Point-to-Point" control wiring diagrams showing control and protective systems interlocks.

B. Provide Nameplate Engraving Schedule.

1.3 APPLICABLE STANDARDS (ADDITIONAL REQUIREMENTS)

A. The Equipment shall be designed, tested and assembled to comply with ANSI, IEEE, and NEMA and UL.

1. UL 1244 Electrical and Electronic Measuring and Test Equipment.

PART 2 - PRODUCTS

2.1 GENERAL

A. Function

1. Electronic digital metering, microprocessor based data measurement and data recording of simultaneous occurring continuously operating analog conditions, simultaneously with data recording of individual occurrence instantaneous events.
2. The supplemental metering is secondary to the utility revenue metering, as separate independent sub-metering systems. Shall provide tracking of the status, consumption and flow of the unit-values monitored by the respective supplemental metering systems.
3. The meters shall connect analog to digital, not less than 24-bit analog to digital conversion, certified to National Accuracy Standards. UL listed and labeled. Provide local readable visual meter displays, local digital data storage and digital data communications with remote locations.
4. Measurement accuracy shall be better than 0.5% and comply with IEC687 (Class 0.5%) and ANSI C12.20 (Class 0.5%). Combined meter and current transformers and related software systems operational accuracy for the electrical power sub-metering systems shall comply with ANSI-C 12.20 and the Public Utility Commission revenue grade accuracy compliance. The sub-metering systems accuracy

shall also comply with Savings-by-Design Program Requirements and U.S. Green Building Council Program Requirements, including but not limited to the following:

a. +0.5% at 1.0 power factor and 1% through 100% of rated current.
b. ±0.75% at 0.5 power factor and 1% through 100% of rated current.

5. Front of meter operator control of meter functions.
6. Ambient operating temperature range minus 15-degrees centigrade to plus 50-degree centigrade.
7. Flammability rating UL94-5V, self-extinguishing, non-flame propagating.

B. Sub-Metering Communications

1. Each meter shall provide full duplex bi-directional network communications. Shall provide connection ports for laptop portable computer/PDA and for remote data collection and monitoring.
2. Provide the following wired meter network connections in each meter

a. EIA RS-485 serial port for direct connect locally at each meter.
b. IEEE compliant TCP/IP Fast Ethernet, with RJ-45 port connect and with Power-Over-Ethernet (POE) for remote communications at each meter.

3. Meters shall record and store monitoring data in static non-volatile memory. Not less than 60-calendar days of memory storage capacity. The stored data shall be available for local display on operator demand at the meter and for downloading from the meter by the following.

a. Portable laptop computer/PDA connected (plug-in) to the meter communication port.
b. Metering communications network for Automatic Metering Reading-AMR from remote locations using the metering LAN network.

4. Meter electrical operating power.

a. Provide meter internal electrical power supplies, batteries shall not be the source of normal meter electrical power.
b. Meters monitoring electrical power circuits shall connect to the monitored electrical circuit for meter operating power. Provide protective fusing.
c. Meters monitoring non-electrical systems shall operate on 120 volt 60Hz AC branch circuit electrical power.

5. Bi-directional monitoring for Net-Metering applications.

2.2 ELECTRICAL POWER METERING

A. General

1. The meters shall be microprocessor controlled, digital, measuring and indicating meters.
2. Meter enclosure nominal size 8-inches x 8-inches by 4-inches deep, surface mounting, self-contained, dust proof, insulating electrical housing.
3. The meter shall be rated for direct circuit connects up to 600 volt AC. Single-Phase; Three-phase “WYE” or “Delta” to match the monitored circuit configuration. Provide bus-tap voltage, with current limiting 15-amp 3-pole circuit breaker or 2-pole circuit breaker, as applicable.

4. The meter shall accommodate input connect through split core instrument Current Transformers (CT). Provide a CT for each phase, compatible with the install location. Three CT's for three-phase systems and two CT's for single-phase systems.
5. The meter shall be compatible with the input voltage, CT input/output ratios.
6. Shall provide proper operation over distance of up to 100 feet meter wiring circuit length from the meter to the respective CT location.
7. Meter Withstand Ratings:

    a. Continuous current overload 100%.
    b. Surge 10-times rating for 3-Seconds

8. As manufactured by Electro Industries-Shark Series; or equal.

B. Meter Monitoring and Measurements Range.

1. The meter shall provide multi-function monitoring for three-phase and single-phase as applicable.

    a. Real time kilowatt kW load
    b. Cumulative kilowatt hour kWh load
    c. Peak kilowatt demand with time and date adjustable window of 15-minute or 30-minute intervals

2. Direct-read at each meter location, 8-digit LCD visual display of measured data parameters.

2.3 AUTOMATIC METER READING-AMR

A. General

1. Remote AMR communications data recovery and data analysis from the Sub-meters shall occur by the following methods:

    a. Wired meter communications LAN network.
    b. Typical for Switchboard Owner metering and Panelboard Owner metering.

2. The monitor and communications software shall communicate with the Supplemental Metering and Sub-metering system using the AMR communications pathways.
3. Provide meter LAN Network communications Gateway to translate metering system LAN communications protocols with the communications protocols for the Building Automation System BAS-EMCS. Coordinate with BAS EMCS.
4. Provide communications port-card for the Supplemental Metering and Sub-metering system. The port-card shall connect to the PC workstation computer. Operate and communicate with the metering system and the PC workstation monitoring/communicating metering software.

B. Wired Meter Communications Meter LAN Network Pathway

1. Wired meter network operating over IEEE compliant TCP/IP Fast Ethernet LAN Network. ANSI/ EIA/TIA Category-6, 4-pair UTP with RJ-45 connectors.

2.4 MONITORING AND COMMUNICATING SOFTWARE

A. General

1. The monitoring and communicating software shall provide a complete and comprehensive enterprise wide operation of the metering system. Provide concurrent multi-user software site license for the entire system.
2. Graphic User Interface (GUI) operation, programming and configuration of meters.
3. Real-time viewing capability, data-logging and viewing of historical logs.
4. Communication with sub-meters through Ethernet TCP/IP, direct (plug-in) Serial port, and remote RF Wireless. Shall operate on pc-computers with Microsoft-Windows© operating system.
5. Provide charting, graphing, and analysis of data. Provide viewing of sub-meter records with comprehensive data analysis.
6. ODBC databases for all collected data.
7. Meter reading full reporting capability, utilizing artificial intelligence to diagnose events and provide possible cause scenarios.
8. Client billing and invoice statements for monthly payment by Clients of consumed measure values.
9. Audible and email alarms of selected conditions.
10. WEB Internet access to all meter data.
11. Install, set up and program all software for a fully functional AMR system.

B. Software Functions

1. Connection between remote meters via Serial, Ethernet, RF wireless or Modem. Shall function with all the meters in the Supplemental Metering and Sub-meter system.
2. Viewing of real-time metered data, configuring of meters, and analyzing of collected information from the remote sub-meters.

    a. View real-time readings of all measured parameters.
    b. Configure and analyze collected data from remote sub-meters.
    c. Collect and archive all data.

3. Computer screen display, graphing and reporting functions for collection and archiving of data. ODBC-compliant database structures, stored metering information integrated automatically into other 3rd party software packages. Shall also support .csv file format, auto-configurable. Real-time viewing capability shall include:

    a. Volume, flow, voltage, current, power, and energy
    b. Time of usage and accumulations
    c. Alarms and limits
    d. Max. and min. for each parameter
    e. I/O device information

4. Real-time viewing of data in graphical format. Charting and graphing functions access to any desired data analysis.

    a. Calculation of power quality on a scatter graph
    b. CBEMA plotting information
    c. 3D plots and histograms provided to aid in determining frequency and severity of monitored events.
    d. Graphical data analysis by the base software.

e. Viewing of stored waveforms, events caused by monitored system problems, faults, transients, and other conditions.

C. Reports

1. Reporting software shall provide a comprehensive report on each meter, making use of Artificial Intelligence (AI) technology to diagnose the events and provide the possible cause of the event.
2. AI generated industry accepted solution as a result of the analysis of the monitored event. The AI program of the reporting software package shall make use of Fuzzy Logic, Neural Networks, embedded knowledge, and embedded rules to generate correct analysis and solutions.
3. Create tenant billing invoice statement for individual tenant consumption of measured values by the sub-metering system.
4. The software shall have a Primary Reports server and a Standby Reports server. If the primary server is not running, the user shall be capable of connecting to the standby server.
5. User specify report writing at project startup or other user-defined times, or on the occurrence of user-defined triggers or conditions.
6. User specify report printing when run or saved to storage disk for later printing. The software shall allow user to format report variables.

D. Remote Server

1. Shall support the receiving of data strings from remote sub-meters in the field. The software shall check the monitoring system for connected remote sub-meters and assign incoming calls. Display warnings and to send email, pager, or phone notification of alarm conditions.

E. Security

1. The software shall have advanced security features, allowing password protection through up to five levels of privileges. The password protection shall allow restriction of access to specific screens and/or functions.
2. The operator shall be automatically logged out after a specified amount of inactivity time. The soft-ware shall still be active, but the user shall be restricted to 0 privilege level access after automatic logout.
3. Shall run as either a service or a shell under Microsoft Windows, to disable switching to other Windows applications while the software is running.
4. Allow disabling of the Ctrl-Alt-Delete shortcut key, to restrict operator access to other Windows applications.
5. Not less than two types of alarms: hardware alarms and configurable alarms. Issue alarms for devices going offline and other hardware conditions. User define alarm conditions for configurable alarms. Allow the following four types of configurable alarms: digital alarms, time-stamped alarms, analog alarms, and advanced alarms. Create a project page to display alarms and allow for operator intervention. Alarms must be able to be ordered into categories for prioritization and display.
6. Online Help functions, including a complete Help guide, navigable with forward and back buttons, an Index, and a Search function. Shall have complete context-sensitive help in all of the development screens.

F. Configuration

1. The software shall contain Wizards that allow quick and easy setup of configurable devices and the main control unit.
2. Shall provide Genies already programmed for metering devices. These Genies shall be configured to access and show real-time readings.

3. Shall contain pre-programmed tags for trending and graphing, reporting, events logging, and alarm conditions.
4. The configuration mode shall use forms and templates for data entry during development.
5. The configuration shall utilize Vectoral Graphics. The end user shall be capable of:

    a. Importing graphics and editing them
    b. Creating custom symbols and other objects and animating them, copying them, and moving them on the screen
    c. Connecting symbols and objects and moving them around on the screen
    d. Assigning tags to objects, such as metering devices, to display information and perform functions
    e. Creating links to other screens and programs from devices and/or buttons
    f. Assigning access rights to objects on the screen
    g. Assigning keyboard commands to objects on the screen, activated by clicking on an object, moving over an object, or releasing a “click” on an object
    h. Configuring objects to change when the project is in Runtime Mode, or when a pre-defined condition exists, e.g., a metering device has gone offline
    i. Assigning actions consequent on an object being clicked
    j. Configuring more than one project at a time, utilizing the same workstation

PART 3 - EXECUTION

3.1 INSTALLATION

A. A Branch Circuit Breaker shall be provided at the metering location to allow safe access to metering components without powering down the entire electrical system.

B. All Meters, Metering Equipment and Software shall be installed to comply with Manufacturer’s installation instructions and recommendations.

C. Wiring Connects (Additional Requirements)

1. Provide communication connections,
2. One 0.75-inch conduit with two Category-6 cables, homerun to nearest IDF/MDF room patch panel.

    a. From each meter location

3.2 SYSTEM COMMISSIONING AND START-UP

A. Contractor to provide setup, testing and programming of metering system and “Commissioning”. Shall be performed prior to occupancy.

1. Record the “cross reference” or the meter serial number (unique ID), meter point, to monitor load relationship.
2. Check for power to the meter.
3. Check the serial number inside the meter.
4. Open the panel so that all CT’s are visible.
5. Verify the CT ratio and write up the cross reference information for the meter.
6. Confirm the “cross reference”. Turn on a known load in the respective monitor load unit on each phase.
7. Verify the meter’s phase diagnostics for the assigned monitor load. Confirm that there is a significant increase on the load for each phase of the meter point.

8. After phases have been checked and loads are still running, turn off the breaker serving the monitor load and confirm that all loads are disconnected.

B. Test Results:

1. Submit two draft copies of Test results to the Owner's Representative.
2. After approval submit the test results in two final printed copies and one computer readable copy.

C. Testing shall include Testing of Communications between Sub-Meters, Communications Modules, Transponders and Remote Monitoring AMR locations.

1. Testing shall confirm that all power meters included in cross-reference are properly communicating.
2. Testing shall confirm that remote connection is complete.
3. Testing shall confirm that all Transponders and the networks are communicating properly.

END OF SECTION 260910
040119/212227

SECTION 260943 - LIGHTING CONTROL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Digital-Network Lighting Control System and Associated Components (See Section 09113 for General Commissioning Requirements):

1. Power panels.
2. LED drivers.
3. Lighting control modules (Lutron EnergiSavr Node).
4. Lighting management hubs.
5. Lighting management system computers.
6. Lighting management system software.
7. Control stations.
8. Low-voltage control interfaces.
9. Wired sensors.
10. Wireless sensors.
11. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 260500 – Common Work Results for Electrical

B. Section 265000 – Lighting Fixtures

1.3 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices; Code of Federal Regulations; current edition.

B. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts - Supplements.

C. ANSI/ESD S20.20 - Standard for the Development of an Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices).

D. ASTM D4674 - Standard Practice for Accelerated Testing for Color Stability of Plastics Exposed to Indoor Office Environments

E. CAL TITLE 24 P6 - California Code of Regulations, Title 24, Part 6 (California Energy Code).

F. IEC 60669-2-1 - Switches for Household and Similar Fixed Electrical Installations - Part 2-1: Particular Requirements - Electronic Switches.

G. IEC 60929 - AC and/or DC-Supplied Electronic Control Gear for Tubular Fluorescent Lamps - Performance Requirements.

H. IEC 61000-4-2 - Electromagnetic Compatibility (EMC) - Part 4-2: Testing and Measurement Techniques - Electrostatic Discharge Immunity Test.

I. IEC 61000-4-5 - Electromagnetic Compatibility (EMC) - Part 4-5: Testing and Measurement Techniques - Surge Immunity Test.

J. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits.

K. ISO 9001 - Quality Management Systems-Requirements.

L. NECA 1 - Standard for Good Workmanship in Electrical Construction.

M. NECA 130 - Standard for Installing and Maintaining Wiring Devices; National Electrical Contractors Association.

N. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; National Electrical Manufacturers Association.

O. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association.

P. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Q. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances; Current Edition, Including All Revisions.

R. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

S. UL 508 - Industrial Control Equipment; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

T. UL 508A - Industrial Control Panels; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

U. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

V. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

W. UL 1598C - Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits; Current Edition, Including All Revisions.

X. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of sensors and wall controls with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate the placement of wall controls with actual installed door swings.
3. Coordinate the placement of daylight sensors with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
4. Coordinate the work to provide luminaires and lamps compatible with the lighting controls to be installed.
5. Notify Architect of any conflicts or deviations from the Contract Documents to obtain direction prior to proceeding with work.

B. Pre-Wire Meeting: Conduct on-site meeting with Lighting Control System Manufacturer prior to commencing work as part of Manufacturer's standard startup services. Manufacturer to review with Installer:

1. Low Voltage Wiring Requirements.
2. Separation of power and low voltage/data wiring.
3. Wire labeling.
4. Lighting management hub locations and installation.
5. Control locations.
6. Computer jack locations.
7. Load circuit wiring.
8. Network Wiring Requirements.
9. Connections to other equipment and other Lutron equipment.
10. Installer responsibilities.
11. Power panel locations.

C. Sequencing:

Do not install sensors and wall controls until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, Service Condition Requirements, and installed features.

1. Occupancy/Vacancy Sensors: Include detailed basic motion detection coverage range diagrams.

C. Shop Drawings:

1. Provide schematic system riser diagram indicating component interconnections. Include Requirements for interface with other systems.
2. Provide detailed sequence of operations describing system functions.

D. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by Product Testing Agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Title 24 Acceptance Testing Documentation: Submit Certification of Acceptance and associated documentation for lighting control acceptance testing performed in accordance with CAL TITLE 24 P6, as specified in Part 3 under "COMMISSIONING".

F. Operation and Maintenance Data: Include detailed information on lighting control system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

G. Warranty: Submit Sample of Manufacturer's Warranty or Enhanced Warranty as specified in Part 1 under "WARRANTY". Submit documentation of final execution completed in Owner's name and registered with Manufacturer.

1.6 QUALITY ASSURANCE

A. Conform to Requirements of NFPA 70.

B. Maintain at the Project Site a copy of each referenced document that prescribes Execution Requirements.

C. Manufacturer Qualifications:

1. Company with not less than 10-years of experience manufacturing lighting control systems of similar complexity to specified system.
2. Registered to ISO 9001, including in-house engineering for product design activities.
3. Qualified to supply specified products and to honor claims against product presented in accordance with warranty.

D. Title 24 Acceptance Testing Technician Qualifications: Certified by a California approved Acceptance Test Technician Certification Provider (ATTCP) as an Acceptance Test Technicians (ATTs) in accordance with CAL TITLE 24 P6.

1.7 DELIVERY, STORAGE, AND HANDLING

Store products in a clean, dry space in Original Manufacturer's packaging in accordance with Manufacturer's written instructions until ready for installation.

1.8 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional Warranty Requirements.

B. Manufacturer's Standard Warranty, with Manufacturer Start-Up; Lutron Standard 2-year Warranty; Lutron LSC-B2:

1. Manufacturer Lighting Control System Components, Except Lighting Management System Computer, Ballasts/Drivers and Ballast Modules:

a. First Two Years:

1) 100% replacement parts coverage, 100% Manufacturer labor coverage to troubleshoot and diagnose a lighting issue.
2) First-available on-site or remote response time.

3) Remote diagnostics for applicable systems.

b. Telephone Technical Support: Available 24 hours per day, 7 days per week, excluding Manufacturer holidays.

2. Lighting Management System Computer: One year 100% parts coverage, 1-year 100% Manufacturer labor coverage.
3. Ballasts/Drivers and Ballast Modules: 5-years 100% parts coverage, no Manufacturer labor coverage.

C. Include as part of the base bid additional costs for Manufacturer's Enhanced Warranty with Manufacturer Start-up; Silver Enhanced Warranty; Lutron LSC-E8S; coverage to include items listed under Manufacturer's standard warranty with Manufacturer start-up above, plus the following upgrades:

1. Manufacturer Lighting Control System Components, Except Lighting Management System Computer, Ballasts/Drivers and Ballast Modules:

a. First Two Years:

1) As-available Field Service response; no committed response time.

b. Additional Coverage for year’s 3-5: 50% replacement parts coverage, no Manufacturer labor coverage.
c. Additional Coverage for year’s 6-8: 25% replacement parts coverage, no Manufacturer labor coverage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: Lutron Electronics Company, Inc.; www.lutron.com.

B. Substitutions: See Section 016000 - Product Requirements.

1. All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by Architect a minimum of 10 working days prior to the bid date and must be made available to all bidders. Proposed substitutes must be accompanied by a review of the Specification noting compliance on a line-by-line basis.
2. By using pre-approved substitutions, Contractor accepts responsibility and associated costs for all required modifications to related equipment and wiring. Provide complete Engineered Shop Drawings (including power wiring) with deviations from the original design highlighted in an alternate color for review and approval by Architect prior to rough-in.

2.2 DIGITAL-NETWORK LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS

A. Sensor Layout and Tuning: No Lighting Control Manufacturer Sensor Layout and Tuning service to be provided; Lutron LSC-NO-SENS-LT.

1. Contractor to utilize Lighting Control Manufacturer Installation Instructions to place/install sensors.

2. At Pre-wire and Startup, Lighting Control Manufacturer to provide a rough sensor calibration only. Sensor fine-tuning to be the responsibility of Contractor.

B. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) as suitable for the purpose indicated.

C. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the control intent indicated.

D. Design lighting control equipment for 10 year operational life while operating continually at any temperature in an ambient temperature range of 32 degrees F (0 degrees C) to 104 degrees F (40 degrees C) and 90% non-condensing relative humidity.

E. Electrostatic Discharge Tolerance: Design and test equipment to withstand electrostatic discharges without impairment when tested according to IEC 61000-4-2.

F. Dimming and Switching (Relay) Equipment:

1. Designed so that electrolytic capacitors operate at least 36 degrees F (20 degrees C) below the capacitor's maximum temperature rating when the device is under fully loaded conditions at maximum rated temperature.
2. Inrush Tolerance:

    a. Utilize load-handling thyristors (SCRs and triacs), field effect transistors (FETs) and isolated gate bipolar transistors (IGBTs) with maximum current rating at least two times the rated operating current of the dimmer/relay.
    b. Capable of withstanding repetitive inrush current of 50 times the operating current without impacting lifetime of the dimmer/relay.

3. Surge Tolerance:

    a. Panels: Designed and tested to withstand surges of 6,000 V, 3,000 amps according to IEEE C62.41.2 and IEC 61000-4-5 without impairment to performance.
    b. Other Power Handling Devices: Designed and tested to withstand surges of 6,000 V, 200 amps according to IEEE C62.41.2 without impairment to performance.

4. Power Failure Recovery: When power is interrupted and subsequently restored, within 3 seconds lights to automatically return to same levels (dimmed setting, full on, or full off) as prior to power interruption.
5. Dimming Requirements:

    a. Line Noise Tolerance: Provide real-time cycle-by-cycle compensation for incoming line voltage variations including changes in RMS voltage (plus or minus 2% change in RMS voltage per cycle), frequency shifts (plus or minus 2Hz change in frequency per second), dynamic harmonics, and line noise.

        1) Systems not providing integral cycle-by-cycle compensation to include external power conditioning equipment as part of dimming system.

    b. Incorporate electronic "soft-start" default at initial turn-on that smoothly ramps lights up to the appropriate levels within 0.5 seconds.
    c. Utilize air gap off to disconnect the load from line supply.

d. Control all light sources in smooth and continuous manner. Dimmers with visible steps are not acceptable.
e. Load Types:

1) Assign a load type to each dimmer that will provide a proper dimming curve for the specific light source to be controlled.
2) Provide capability of being field-configured to have load types assigned per circuit.

f. Minimum and Maximum Light Levels: User adjustable on a circuit-by-circuit basis.
g. Line Voltage Dimmers:

1) Dimmers for Magnetic Low Voltage (MLV) Transformers:

a) Provide circuitry designed to control and provide a symmetrical AC waveform to input of magnetic low voltage transformers per UL 1472.
b) Dimmers using unipolar load current devices (such as FETs or SCRs) to include DC current protection in the event of a single device failure.

2) Dimmers for Electronic Low Voltage (ELV) Transformers: Operate transformers via reverse phase control. Alternately, forward phase control dimming may be used if Dimming Equipment Manufacturer has recommended specific ELV transformers being provided.
3) Dimmers for Neon and Cold Cathode Transformers:

a) Magnetic Transformers: Listed for use with normal (low) power factor magnetic transformers.
b) Electronic Transformers: Must be supported by the Ballast Equipment Manufacturer for control of specific ballasts being provided.

h. Low Voltage Dimming Modules:

1) Coordination Between Low Voltage Dimming Module and Line Voltage Relay: Capable of being electronically linked to a single zone.
2) Single low voltage dimming module; capable of controlling the following light sources:

a) 0-10V analog voltage signal.

- Provide Class 2 isolated 0-10V output signal conforming to IEC 60929.
- Sink current according to IEC 60929.
- Source current.

b) 10-0V reverse analog voltage signal.
c) DSI digital communication.
d) DALI broadcast communication per IEC 60929:

- Logarithmic intensity values complying with IEC 60929.
- Linear intensity values for use with LED color intensity control.

e) PWM per IEC 60929.

6. Switching Requirements:

a. Rated Life of Relays: Typical of 1,000,000 cycles at fully rated 16A for all lighting loads.

b. Switch load in a manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.
c. Provide output fully rated for continuous duty for inductive, capacitive, and resistive loads.

G. Device Finishes:

1. Standard Colors: Comply with NEMA WD1 where applicable.
2. Color Variation in Same Product Family: Maximum delta E of 1, CIE L*a*b color units.
3. Visible Parts: Exhibit ultraviolet color stability when tested with multiple actinic light sources as defined in ASTM D4674. Provide proof of testing upon request.

2.3 POWER PANELS

A. Provide power panels with configurations as indicated on the Drawings.

B. General Requirements:

1. Listed to UL 508 as industrial control equipment.
2. Comply with UL 508A and IEC 60669-2-1 as applicable.
3. Delivered and installed as a listed factory-assembled panel.
4. Field wiring accessible from front of panel without removing dimmer assemblies or other components.
5. Passively cooled via free-convection, unaided by fans or other means.
6. Shipped with each dimmer in mechanical bypass position by means of jumper bar inserted between input and load terminals. Jumpers to carry full rated load current and be reusable at any time. Mechanical bypass device to allow for switching operation of connected load with dimmer removed by means of circuit breaker.
7. Provided with branch circuit protection for each input circuit unless the panel is a dedicated feed-through type panel or otherwise indicated on the Drawings.
8. Branch Circuit Breakers:

   a. Listed to UL 489 as molded case circuit breaker for use on lighting circuits.
   b. Provided with visual trip indicator.
   c. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
   d. Thermal-magnetic construction for overload, short-circuit, and over-temperature protection. Use of breakers without thermal protection requires dimmers/relays to have integral thermal protection to prevent failures when overloaded or ambient temperature is above rating of panel.
   e. Equipped with provision for tag-out/lock-out devices to secure circuit breakers in off position when servicing loads.
   f. Replaceable without moving or replacing dimmer/relay assemblies or other panel components.
   g. Listed as Switch Duty (SWD) so that loads can be switched on and off by breakers.

9. Provide panels with listed short circuit current rating not less than the available fault current at the installed location as indicated on the Drawings.
10. Panel Processor; Lutron Circuit Selector:

    a. Provide the following capabilities:

       1) Operate circuit directly from panel processor for system diagnostics and provide feed-back of system operation.
       2) Electronically assign each circuit to any zone in lighting control system.

3) Determine normal/emergency function of panel and set emergency lighting levels.

b. React to changes from control within 20 milliseconds.

11. Diagnostics and Service:

a. Replacing dimmer/relay does not require re-programming of system or processor.
b. Include diagnostic LEDs for dimmers/relays to verify proper operation and assist in system troubleshooting.
c. Include tiered control scheme for dealing with component failure that minimizes loss of control for occupant.

1) If lighting control system fails, lights to remain at current level. Panel processor provides local control of lights until system is repaired.
2) If panel processor fails, lights to remain at current level. Circuit breakers can be used to turn lights off or to full light output, allowing non-dim control of lights until panel processor is repaired.
3) If dimmer fails, factory-installed mechanical bypass jumpers to allow each dimmer to be mechanically bypassed. Mechanical bypass device to allow for switching operation of connected load with dimmer removed by means of circuit breaker.

C. Product(s):

1. Relay Panels:

a. Product: Lutron XP Series Switching Panels.
b. Provide surface-mounted or flush-mounted enclosures as indicated.
c. Switching Requirements:

1) Utilize 20A continuous-use rated switching modules; able to switch 20 A receptacles.
2) Rated Life of Relay: Typical of 1,000,000 cycles at fully rated 16 A for all lighting loads.
3) Switch load in a manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.
4) Provide output fully rated for continuous duty for inductive, capacitive, and resistive loads.

2.4 LED DRIVERS

A. General Requirements:

1. Operate for at least 50,000 hours at maximum case temperature and 90 percent non-condensing relative humidity.
2. Provide thermal fold-back protection by automatically reducing power output (dimming) to protect LED driver and LED light engine/fixture from damage due to over-temperature conditions that approach or exceed the LED driver's maximum operating temperature at calibration point.
3. Provide integral recording of operating hours and maximum operating temperature to aid in trouble-shooting and warranty claims.
4. Designed and tested to withstand electrostatic discharges incurred during manufacturing, installation, or field troubleshooting without impairment of performance when tested according to IEC 61000-4-2.
5. Manufactured in a facility that employs ESD reduction practices in compliance with ANSI/ESD S20.20.
6. UL 8750 recognized or listed as applicable.

7. UL Type TL rated where possible to allow for easier fixture evaluation and listing of different driver series.
8. UL 1598C listed for field replacement as applicable.
9. Designed and tested to withstand Category A surges of 4,000 V according to IEEE C62.41.2 without impairment of performance.
10. Class A sound rating; inaudible in a 27 dBA ambient.
11. Demonstrate no visible change in light output with a variation of plus or minus 10% change in line-voltage input.
12. LED drivers of the same family/series to track evenly across multiple fixtures at all light levels.
13. Offer programmable output currents in 10 mA increments within designed driver operating ranges for custom fixture length and lumen output configurations, while meeting a low-end dimming range of 100% to 1% or 100% to 5% as applicable.
14. Meet NEMA 410 Inrush Requirements.
15. Employ integral fault protection up to 277 V to prevent LED driver damage or failure in the event of incorrect application of line-voltage to communication link inputs.
16. LED driver may be remote located up to 100 feet (30 m) from LED light engine depending on power outputs required and wire gauge utilized by installer.

B. Digital Control (when used with compatible Lutron lighting control systems):

1. Employ power failure memory; LED driver to automatically return to the previous state/light level upon restoration of utility power.
2. Operate from input voltage of 120 V through 277 V at 50/60Hz.
3. Automatically go to 100% light output upon loss of control link voltage and lock out system commands until digital control link voltage is restored. Manufacturer to offer UL 924 compliance achievable through use of external Lutron Model LUT-ELI-3PSH interface upon request.
4. Each driver responds independently per system maximum:

    a. Up to 32 occupant sensors.
    b. Up to 16 daylight sensors.

5. Responds to digital load shed command. (Example: If light output is at 30% and a load shed command of 10% is received, the ballast automatically sets the maximum light output at 90% and lowers current light output by 3% to 27%).
6. Digital low-voltage control wiring capable of being wired as either Class 1 or Class 2.

C. Product(s):

1. Digital Control, Five Percent Dimming; Lutron 5-Series (LDE5-Series):

    a. Dimming Range: 100% to 5% measured output current.
    b. Typically dissipates 0.2 W standby power at 120 V and 0.3 W standby power at 277 V.
    c. Complies with FCC Requirements of CFR, Title 47, Part 15, for commercial applications at 120-277 V.
    d. Constant Current Reduction (CCR) dimming method.
    e. Total Harmonic Distortion (THD): Less than 21% at full load; complies with ANSI C82.11.

    f. Constant Current Drivers:

1) Support for downlights and pendant fixtures in select currents from 350 mA to 1.4 A to ensure a compatible driver exists.

a) Support LED arrays up to 35 W.
b) Models available that meet Requirements for Energy Star compliance.

2) Support for troffers, linear pendants, and linear recessed fixtures from 150 mA to 2.1 A to ensure a compatible driver exists.

a) Support LED arrays up to 75 W.
b) Models available to meet the Design Lights Consortium (DLC) power line quality Requirements.

2. Digital Control, 1% Dimming with Soft-On and Fade-to-Black Low End Performance; Lutron Hi-lume 1% Soft-on Fade-to-Black (LDE1-Series):

a. Dimming Range: 100% to 1% measured output current.
b. Features smooth fade-to-on and fade-to-black (Lutron Soft-On, Fade-to-Black) low end dimming performance for an incandescent-like dimming experience.
c. Typically dissipates 0.2 W standby power at 120 V and 0.3 W standby power at 277 V.
d. Complies with FCC Requirements of CFR, Title 47, Part 15, for commercial applications at 120-277 V.
e. Employs true Constant Current Reduction (CCR) dimming method from 100 to five percent light level and Pulse Width Modulation (PWM) dimming method from five percent to off.
f. Pulse Width Modulation (PWM) frequency of 240 Hz.
g. Total Harmonic Distortion (THD): Less than 20% at full output for drivers greater than 25 W; complies with ANSI C82.11.
h. UL Class 2 output.
i. Driver outputs to be short circuit protected, open circuit protected, and overload protected.
j. Constant Current Driver; Lutron K-Case Form Factor: Support for fixtures from 220 mA to 1.4 A over multiple operating ranges.

1) Support LED arrays up to 40 W.
2) Models available that meet Requirements for Energy Star compliance.

k. Constant Current Driver; Lutron M-Case Form Factor: Support for fixtures from 150 mA to 2.1 A over multiple operating ranges.

1) Support LED arrays up to 75 W.
2) Models available to meet the Design Lights Consortium (DLC) Power Line Quality Requirements.

2.5 LIGHTING CONTROL MODULES (LUTRON ENERGY SAVER NODE)

A. Provide lighting control modules as indicated or as required to control the loads as indicated.

B. General Requirements:

1. Listed to UL 508 as industrial control equipment.
2. Delivered and installed as a listed factory-assembled panel.
3. Passively cooled via free-convection, unaided by fans or other means.
4. Mounting: Surface.

5. Connection without interface to wired:

    a. Occupancy sensors.
    b. Daylight sensors.
    c. IR receivers for personal control.

6. Connects to lighting management hub via RS485.
7. LED status indicators confirm communication with occupancy sensors, daylight sensors, and IR receivers.
8. Contact Closure Input:

    a. Directly accept contact closure input from a dry contact closure or sold-state output without interface to:

        1) Activate scenes.

            a) Scene activation from momentary or maintained closure.

        2) Enable or disable after hours.

            a) Automatic sweep to user-specified level after user-specified time has elapsed.
            b) System will provide occupants a visual warning prior to sweeping lights to user-specified level.
            c) Occupant can reset timeout by interacting with the lighting system.

        3) Activate or deactivate demand response (load shed).

            a) Load shed event will reduce lighting load by user-specified amount.

9. Emergency Contact Closure Input:

    a. Turn all zones to full output during emergency state via direct contact closure input from UL 924 listed emergency lighting interface, security system or fire alarm system.
    b. Allow configurable zone response during emergency state.
    c. Disable control operation until emergency signal is cleared.

10. Supplies power for control link for keypads and control interfaces.
11. Distributes sensor data among multiple lighting control modules.
12. Capable of being controlled via wireless sensors and controls.

C. 0-10V Lighting Control Modules:

1. Product(s):
2. Coordination Between Low Voltage Dimming Module and Line Voltage Relay: Capable of being electronically linked to single zone.
3. Single low voltage dimming module; capable of controlling following light sources:

    a. 0-10V analog voltage signal.

        1) Provide Class 2 isolated 0-10V output signal conforming to IEC 60929.
        2) Sink current per IEC 60929.

    b. 10V-0V analog voltage signal.

1) Provide Class 2 isolated 0-10V output signal conforming to IEC 60929.
2) Sink current per IEC 60929.

4. Switching:

a. Rated Life of Relay: Typical of 1,000,000 cycles at fully rated 16 A for all lighting loads.
b. Load switched in manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.
c. Fully rated output continuous duty for inductive, capacitive, and resistive loads.
d. Module to integrate up to four individually controlled zones.
e. Utilize air gap off, activated when user selects "off" at any control to disconnect the load from line supply.

D. Digital Fixture Lighting Control Modules:

1. Product(s):

a. Lutron EcoSystem Energi Savr Node; Model QSN-1ECO-S: One EcoSystem Digital Link.
b. Lutron EcoSystem Energi Savr Node; Model QSN-2ECO-S: Two EcoSystem Digital Links.

2. Provides two-way feedback with digital fixtures for energy monitoring, light level status, lamp failure reporting, and ballast/driver failure reporting.
3. Provide testing capability using manual override buttons.
4. Each low-voltage digital communication link to support up to 64 ballasts or LED drivers capable of NFPA 70 Class 1 or Class 2 installation.

2.6 LIGHTING MANAGEMENT HUBS

A. Product: Lutron Quantum Light Management Hub.

B. Provided in a pre-assembled NEMA listed enclosure with terminal blocks listed for field wiring.

C. Connects to controls and power panels via RS485.

D. Enables light management software to control and monitor compatible dimming ballasts and ballast modules, power panels, power modules, and window treatments.

1. Utilizes Ethernet connectivity to light management computer utilizing one of the following methods:

a. Dedicated network.
b. Dedicated VLAN.
c. Shared network with Building Management System (BMS).
d. Corporate network where managed switches are configured to allow multicasting and use of IGMP.

E. Integrates control station devices, power panels, shades, preset lighting controls, and external inputs into a single customizable lighting control system with:

1. Multiple Failsafe Mechanisms:

a. Power failure detection via emergency lighting interface.
b. Protection: Lights go to full on if ballast wires are shorted.
c. Distributed architecture provides fault containment. Single hub failure or loss of power does not compromise lights and shades connected to other lighting management hubs.

2. Manual overrides.
3. Automatic control.
4. Central computer control and monitoring.
5. Integration with BMS via BACnet.

F. Furnished with astronomical time clock.

G. Maintains a backup of the programming in a non-volatile memory capable of lasting more than 10-years without power.

H. BACnet Integration License:

1. Provide ability to communicate by means of native BACnet IP communication (does not require interface) to lighting control system from a user-supplied 10BASE-T or 100BASE-T Ethernet network.
2. Requires only one network connection per system.
3. Lighting control system to be BACnet Test Laboratory (BTL) listed.
4. Basic BACnet integration license:

a. The BACnet integrator can command:

1) Area light output.
2) Area enable or disable after hours mode.
3) Area load shed level.
4) Area load shed enable/disable.
5) Enable/Disable:

a) Area occupancy sensors.
b) Area daylighting.

6) Daylighting level.
7) Area occupied and unoccupied level
8) Occupancy sensor timeouts.

b. The BACnet integrator can monitor:

1) Area on/off status.
2) Area occupancy status.
3) Area fault.

a) Lamp failures.
b) Control devices not responding.

4) Area load shed status.
5) Area instantaneous energy usage and maximum potential power usage.
6) Energy savings broken out by strategy (occupancy, timeclock, daylighting, personal control, tuning, load shed) down to the individual area.
7) Enable/Disable:

a) Area occupancy sensors.
b) Daylighting.
c) Timeclocks.

8) Daylighting level.
9) Light levels from photo sensors or Radio Window sensors.
10) Area occupied and unoccupied level.
11) Occupancy sensor timeouts.

5. Integration with other devices over Ethernet via Telnet using the Lutron Integration Protocol.
6. Control other devices over Ethernet via TCP or Telnet by sending device specific strings.

2.7 LIGHTING MANAGEMENT SYSTEM COMPUTERS

A. Computers:

1. Product: Lutron Q-Manager.
2. System PC (Desktop/Laptop):

a. Suitable for occasional programming, monitoring, and control of digital network lighting controls.
b. Unless otherwise indicated, computer(s) to be provided by others, meeting Lighting Control System Manufacturer's Minimum Requirements.
c. Minimum Hardware Requirements:

1) Processor: Single Intel® Core® i3 processor with minimum speed of 2.4 GHz.
2) 4 GB RAM.
3) 250 GB hard drive (40 GB for application).
4) One 10/100/1000 Ethernet network interface for communication with lighting management hubs.
5) Monitor with 1280 x 1024 resolution.
6) 4 USB 2.0 ports.
7) Dedicated Graphics Card with 256 MB of memory.

d. Minimum Software Requirements:

1) Licensed installation of US English 64-bit Microsoft® Windows® 7 Professional with Service Pack 1, US English 64-bit Microsoft® Windows® 8 Professional, or US English 64-bit Microsoft® Windows® 8.1 Professional.
2) Microsoft® Internet Information Services (IIS) 7 or later.
3) Microsoft® Internet Explorer 9 or later.
4) Microsoft®.NET Framework 3.5.
5) Microsoft®.NET Framework 4.5.

3. Server:

a. Suitable for 24 hour per day, 7 day per week programming, monitoring, control, and data logging of digital-network lighting controls.
b. Suitable to handle client machine request in multi-computer systems.

c. Unless otherwise indicated, computer to be provided by others, meeting Lighting Control System Manufacturer's minimum Requirements.
d. Minimum Hardware Requirements:

1) Processor: Quad Core Intel® Xeon® processor.
2) 8 GB Ram.
3) 250 GB hard drive (40 GB for application and database).
4) Two 10/100/1000 Ethernet network interfaces - one for communication with lighting management hubs and one for communication with corporate intranet to allow access from system PCs and/or energy saving display terminals. Only one Ethernet Network Interface is required if all lighting management hubs and client PCs are on the same network.
5) Monitor with 1280 x 1024 resolution.
6) 4 USB 2.0 ports.
7) Dedicated Graphics Card with 256 MB of memory (only required if running client software from the server).

e. Minimum Software Requirements:

1) Licensed installation of US English 64-bit Microsoft® Windows® Server 2008 R2, Windows Server 2012 R1, or Windows Server 2012 R2.
2) Microsoft® Internet Information Services (IIS) 7 or later.
3) Microsoft® Internet Explorer 9 or later.
4) Microsoft®.NET Framework 3.5.
5) Microsoft®.NET Framework 4.5.

2.8 LIGHTING MANAGEMENT SYSTEM SOFTWARE

A. Provide system software license and hardware that is designed, tested, manufactured, and warranted by a single Manufacturer.

B. Configuration Setup Software:

1. Product: Lutron Q-Design.
2. Suitable to make system programming and configuration changes using a Graphical Floor Plan view or a generic system layout.
3. Windows-based, capable of running on either central server or a remote client over TCP/IP connection.
4. Publish Graphical Floor Plan: Allows the user to publish new Graphical Floor Plan files, allowing users to monitor the status of lights, occupancy of areas, and daylighting status.
5. Back-Up Project Database: Allows the user to back up the Project database that holds all the configuration information for the system, including keypad programming, area scenes, daylighting, occupancy programming, emergency levels, night lights, and time clock.
6. Publish Project Database: Allows the user to send a new Project database to the server and download the new configuration to the system. The Project database holds all the configuration information for the system, including keypad programming, area scenes, daylighting, occupancy programming, emergency levels, night lights, and time clock.
7. Allows Manufacturer (either remotely or with on-site service call) or end-user (with training) to:

a. Capture system design:

1) Geographical layout.
2) Load schedule zoning.

3) Equipment schedule.
4) Equipment assignment to lighting management hubs.
5) Daylighting design.

b. Define the configuration for the following in each area:

1) Lighting scenes.
2) Control station devices.
3) Interface and integration equipment.
4) Occupancy/after hours.
5) Partitioning.
6) Daylighting.
7) Emergency lighting.
8) Night lights.

c. Startup:

1) Addressing.
2) Daylighting.
3) Provide customized conditional programming.

C. Control and Monitor Software:

1. Product: Lutron Quantum Vue.
2. General Requirements:

a. Web-based; runs on most HTML5 compatible browsers (including Internet Explorer, Chrome, and Safari).
b. Supports multiple platforms and devices; runs from a tablet, desktop, laptop, or smartphone; optimized for displays of 1024 by 768 pixels or higher.
c. User interface supports multi-touch gestures such as pinch to zoom, drag to pan, etc.
d. Utilizes HTTPS (industry-standard certificate-based encryption and authentication for security).
e. All functionality listed below must be available via a single application.

3. System Navigation and Status Reporting:

a. Performed using Graphical Floor Plan view or a generic system layout.
b. Graphical Floor Plan View: Utilizes customized CAD Based Drawing of the building. Pan and zoom feature allows for easy navigation; dynamically adjusts the details presented based on zoom level.
c. Area, scene, and zone names can be changed in real time.
d. Adjustments can be made based on area type.

4. Control of Lights:

a. Control and monitor individual lights from a graphical floor plan (with Lutron EcoSystem digital ballasts/drivers).

1) Individual lights can be monitored for on/off status.

2) Individual lights can be turned on/off or sent to a specific level.
3) High end of individual lights can be tuned/trimmed.

b. Control and monitor zone/area lights.

1) Area lights can be monitored for on/off status.
2) All lights in an area can be turned on/off or sent to a specific level.
3) For areas that have been zoned, these areas may be sent to a predefined lighting scene, and individual zones may be controlled.
4) Area lighting scenes can be renamed and modified in real-time, changing the levels that zones go to when a scene is activated.
5) High and low end of area lighting can be tuned/trimmed.

c. Control and monitor area partition status from a Graphical Floor Plan.

5. Occupancy:

a. Area occupancy can be monitored.
b. Area occupancy can be disabled to override occupancy control or in case of occupancy sensor problems.
c. Area occupancy settings including level that lights turn on to when area is occupied, and level that lights turn off to when area is unoccupied can be changed in real-time.
d. Monitor energy savings due to occupancy down to an individual area.

6. Daylighting:

a. Daylighting can be enabled/disabled. Can be used to override the control currently taking place in the space.
b. Daylight calibration can be adjusted for each day lit area.
c. Daylight status can be monitored.
d. Monitor energy savings due to daylight harvesting down to an individual area.

7. Load Shedding; Lutron IntelliDemand: Allows the building manager to monitor whole building lighting power usage and apply a customized load shed reduction to selected areas, thereby reducing a building's power usage; load shedding triggered via Quantum Vue Software or BACnet.

8. Scheduling: Schedule time of day and astronomic time clock events to automate functions.

a. Adjust or disable a single occurrence of a repeating scheduled event.
b. Easily monitor and adjust scheduled events using a weekly calendar view.

9. Reporting: Provide reporting capability that allows the building manager to gather real-time and historical information about the system as follows:

a. Energy Reports: Show a comparison of cumulative energy used over a period of time for one or more areas.
b. Power Reports: Show power usage trend over a period of time for one or more areas.
c. Energy Density Report: Show energy usage in W/sq. ft.

d. Energy Savings by Strategy Report: Show energy savings for any area broken down by strategy (tuning, occupancy, daylighting, scheduled events, personal control, and load shedding).
e. Space Utilization/Occupancy Reports: Show historical occupancy over a period of time for one or more areas using a graphical floor plan, generic system layout, and/or graphs and charts.
f. Activity Report: Show what activity has taken place over a period of time for one or more areas. Activity includes occupant activities (e.g. wall controls being pressed), building manager operation (e.g. controlling/changing areas using the control and monitor tool), and device failures (e.g. keypads or ballasts that are not responding).
g. Lamp Failure Report: Shows which areas are currently reporting lamp failures.
h. Sensor Level Report: Shows the light level in footcandles of any photo sensor in the system.
i. Alert Activity Report: Capable of generating historical reports of all alert activity within the system.

10. Diagnostics: Allows the building manager to check on the status of all equipment in the lighting control system. Devices to be listed with a reporting status of OK, missing, or unknown.
11. Alerts and Alarms: Monitors the system for designated events/triggers and automatically generates alerts according to configured response criteria.

    a. Capable of monitoring for the following events/triggers:

        1) A failed piece of equipment (e.g. ballast, control, sensor, etc.); alert cleared when equipment is replaced.
        2) A lamp outage (for compatible EcoSystem digital electronic dimming ballasts only); alert cleared when lamp is replaced.
        3) Low battery conditions in battery-operated sensors and controls; alert cleared when battery is replaced.
        4) Luminaires with lamp operating hours in excess of designated time.
        5) A load shed event; alert generated for beginning and end of trigger.
        6) Energy usage higher than designated threshold target.
        7) Potential light level condition discrepancies (daylight sensors not agreeing with expected lighting status).
        8) Potential sensor failures (Radio Window sensors that have not seen a change in light level).

    b. View alerts on a customized Graphical Floor Plan.
    c. Capable of generating alerts through visible changes in software or through email messages.
    d. Capable of customizing the frequency of alerts and providing notifications immediately or through daily, weekly, or monthly summaries.
    e. Capable of sending different alerts to different system users.
    f. Capable of generating historical reports of all alert activity within the system.

12. Administration:

    a. Users: Allows new user accounts to be created and existing user accounts to be edited.

        1) Supports Active Directory (LDAP) tying user accounts to network accounts.

b. Area and feature access can be restricted based on login credentials with assigned levels of access rights (Monitor, Control Only, Control and Edit, Admin) and customized access levels available.

13. Quick Controls: Create shortcuts to activate customized system-wide actions, such as updating lighting and/or shade levels.
14. Provides control/monitoring of partition status to automatically reconfigure how the space operates based on the partition's open/closed status.
15. Variables: Used for custom program of a system and/or to signal a third party system. Any change may cause a change in the behavior of the system.

    a. View the current state of system variables across subsystems.
    b. Update the current variable state across all subsystems.

16. Device Lock/Unlock: Allows the building manager to lock control station devices to prevent building occupants from activating their programming (button presses), until they are unlocked.

    a. Keypads can be locked to help ensure occupants cannot change light and shade levels in a public space during specific events or business hours.
    b. Keypads can be unlocked after events/during afterhours to allow maintenance, cleaning, security, and others to perform their tasks without needing to contact a Building Manager.

D. Contractor shall provide factory commissioning to support pre-functional and functional testing with CxA witnessing. See General Commissioning Requirements Section 019113.

2.9 CONTROL STATIONS

A. Provide control stations with configuration as indicated or as required to control the loads as indicated.

B. Wired Control Stations:

1. General Requirements:

    a. Power: Class 2 (low voltage).
    b. UL listed.
    c. Provide faceplates with concealed mounting hardware.
    d. Borders, logos, and graduations to use laser engraving or silk-screened graphic process that chemically bonds graphics to faceplate, resistant to removal by scratching and cleaning.
    e. Finish: As specified for wall controls in "Device Finishes" under DIGITAL NETWORK LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS article above.

2. Multi-Scene Wired Control:

    a. General Requirements:

        1) Allows control of any devices part of the lighting control system.
        2) Allows for easy reprogramming without replacing unit.
        3) Replacement of units does not require reprogramming.

4) Communications: Utilize RS485 wiring for low-voltage communications link.
5) Engrave keypads with button, zone, and scene descriptions as indicated on the Drawings.
6) Software Configuration:

a) Customizable control station device button functionality:

- Buttons can be programmed to perform single defined action.
- Buttons can be programmed to perform defined action on press and defined action on release.
- Buttons can be programmed using conditional logic off of a state variable such as time of day or partition status.
- Buttons can be programmed to perform automatic sequence of defined actions.
- Capable of deactivating select keypads to prevent accidental changes to light levels.
- Buttons can be programmed for raise/lower of defined loads.
- Buttons can be programmed to toggle defined set of loads on/off.

7) Status LEDs:

a) Upon button press, LEDs to immediately illuminate.
b) LEDs to reflect the true system status. LEDs to remain illuminated if the button press was properly processed or LEDs to turn off if the button press was not processed.
c) Support logic that defines when LED is illuminated:

- Scene logic (logic is true when all zones are at defined levels).
- Room logic (logic is true when at least one zone is on).
- Pathway logic (logic is true when at least one zone is on).
- Last scene (logic is true when spaces are in defined scenes).

b. Wired Keypads; Lutron see Touch QS Wallstations:

1) Style: Architectural Non-Insert Style.
2) Mounting: Wallbox or low-voltage mounting bracket; provide wall plates with concealed mounting hardware.
3) Button/Engraving Backlighting:

a) Utilize backlighting for buttons and associated engraving to provide readability under all light conditions.
b) Backlight intensity adjustable via programming software.

4) Design keypads to allow field-customization of button color, configuration, and engraving using field-changeable replacement kits.
5) Contact Closure Interface: Provide two contact closure inputs on back of unit which provide independent functions from front buttons; accepts both momentary and maintained contact closures.
6) Terminal block inputs to be over-voltage and miswire-protected against reversals and shorts.

c. Wired Keypads; Lutron QS Wired Palladiom Wallstations:

1) Style: Architectural Style.
2) Mounting: Wallbox; provide wall plates with concealed mounting hardware.

3) Buttons and Faceplate:

a) Buttons to be greater than 0.65 inch (16.5 mm) in height to provide large target area for ease of use and actuation.
b) Front of buttons to be flush with faceplate.
c) Buttons and faceplate to be of the same material and finish (e.g. plastic/plastic, glass/glass, metal/metal).
d) Buttons to depress and provide tactile feedback of a successful button push. Controls utilizing capacitive or resistive touch technology are not acceptable.
e) Gaps to be less than 0.007 inch (0.18 mm) between buttons and less than 0.15 inch (3.8 mm) between buttons and faceplate.

4) Button/Engraving Backlighting:

a) Backlighting to be visible through engraved text to provide clear readability in a variety of lighting conditions.
b) Indicate active scene through the intensity of the backlighting (brighter backlit text indicates the active state).
c) Backlight intensity adjustable via programming software; capable of dynamic adjustment during usage based on conditional logic (time of day, button press, etc.).
d) Backlight intensity automatically adjusts based on room ambient light level.

5) Keypads to allow field-customization of button color and engraving using field-changeable replacement kits.
6) Terminal block inputs to be over-voltage and miswire-protected against reversals and shorts.

C. Wireless (Radio Frequency) Controls:

1. Product(s):

a. Four-Button; Lutron Pico Wireless Control Model PJ2-4B.

1) Button Marking: Scene keypads (light).

2. Quantity: As indicated on the Drawings.
3. Communicates via radio frequency to compatible dimmers, switches, and plug-in modules.
4. Does not require external power packs, power or communication wiring.
5. Allows for easy reprogramming without replacing unit.
6. Button Programming:

a. Single action.
b. Toggle action.
c. Defined action on press and defined action on release.

7. Includes LED to indicate button press or programming mode status.
8. Mounting:

a. Capable of being mounted with a table stand or directly to a wall under a faceplate.
b. Faceplates: Provide concealed mounting hardware.

9. Power: Battery-operated with minimum 10-year battery life.

10. Finish: As specified for wall controls in "Device Finishes" under DIGITAL-NETWORK LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS article above.

2.10 LOW-VOLTAGE CONTROL INTERFACES

A. Provide Low-Voltage Control Interfaces as indicated or as required to control the loads as indicated.

B. UL listed.

C. Sensor Modules:

1. Products:

a. Sensor module with both wired and wireless inputs; Lutron Model QSM2-4W-C.

2. Wired Modules:

a. Provide wired inputs for:

1) Occupancy sensors.
2) Daylight sensors.
3) IR receivers for personal control.
4) Digital ballast wall stations.

3. Wireless Modules:

a. Provide wireless communication inputs for:

1) Occupancy sensors.
2) Daylight sensors.
3) Wireless controller.

b. RF Range: 30 feet (9 m) between sensor and compatible RF receiving devices.
c. RF Frequency: 434 MHz; operates in FCC governed frequency spectrum for periodic operation; continuous transmission spectrum is not permitted.

4. Communicate sensor information to wired low-voltage digital link for use by compatible devices.

2.11 WIRED SENSORS

A. Wired Occupancy Sensors:

1. General Requirements:

a. Connects directly to compatible ballasts and modules without the need of a power pack or other interface.

b. Turns off or reduces lighting automatically after reasonable time delay when a room or area is vacated by the last person to occupy the space.
c. Accommodates all conditions of space utilization and all irregular work hours and habits.
d. Comply with UL 94.
e. Self-Adaptive Sensors: Continually adjusts sensitivity and timing to ensure optimal lighting control for any use of the space; furnished with field-adjustable controls for time delay and sensitivity to override any adaptive features.
f. Provide capability to:

1) Add additional timeout system-wide without need to make local adjustment on sensor.
2) Group multiple sensors.

g. Power Failure Memory: Settings and learned parameters to be saved in non-volatile memory and not lost should power be interrupted and subsequently restored.
h. Furnished with all necessary mounting hardware and instructions.
i. Class 2 devices.
j. Color: White.

2. Wired Dual Technology Sensors:

a. Passive Infrared: Utilize multiple segmented lenses, with internal grooves to eliminate dust and residue build-up.
b. Ultrasonic: Utilize an operating frequency of 32 kHz or 40 kHz, crystal-controlled to operate within plus/minus 0.005% tolerance.

2.12 WIRELESS SENSORS

A. General Requirements:

1. Operational life of 10 years without the need to replace batteries when installed per Manufacturer's instructions.
2. Communicates directly to compatible RF receiving devices through use of a radio frequency communications link.
3. Does not require external power packs, power wiring, or communication wiring.
4. Capable of being placed in test mode to verify correct operation from the face of the unit.
5. RF Range: 30 feet (9 m) between sensor and compatible RF receiving device(s).
6. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC Requirements of CFR, Title 47, Part 15, for Class B application.

B. Wireless Occupancy/Vacancy Sensors:

1. General Requirements:

a. Provides a clearly visible method of indication to verify that motion is being detected during testing and that the unit is communicating to compatible RF receiving devices.
b. Utilize multiple segmented lenses, with internal grooves to eliminate dust and residue build-up.

c. Sensing Mechanism: Passive infrared coupled with technology for sensing fine motions; Lutron XCT Technology. Signal processing technology detects fine-motion passive infrared (PIR) signals without the need to change the sensor's sensitivity threshold.
d. Provide optional, readily accessible, user-adjustable controls for timeout, automatic/ manual-on, and sensitivity.
e. Turns off lighting after reasonable and adjustable time delay once the last person to occupy the space vacates a room or area. Provide adjustable timeout settings of 1, 5, 15, and 30 minutes.
f. Capable of turning dimmer's lighting load on to an optional locked preset level selectable by the user. Locked preset range to be selectable on the dimmer from 1 percent to 100 percent.
g. Color: White.
h. Provide all necessary mounting hardware and instructions for both temporary and permanent mounting.
i. Provide temporary mounting means to allow user to check proper performance and relocate as needed before permanently mounting sensor. Temporary mounting method to be design for easy, damage-free removal.
j. Sensor lens to illuminate during test mode when motion is detected to allow installer to verify coverage prior to permanent mounting.
k. Ceiling-Mounted Sensors:

1) Provide customizable mask to block off unwanted viewing areas.

2. Wireless Combination Occupancy/Vacancy Sensors:

a. Ceiling-Mounted Sensors: Programmable to operate as an occupancy sensor (automatic-on and automatic-off), an occupancy sensor with low light feature (automatic-on when less than one footcandle of ambient light available and automatic-off), or a vacancy sensor (manual-on and automatic-off).

C. Wireless Daylight Sensors:

1. Product: Lutron Model LFR2-DCRB.
2. Open-loop basis for daylight sensor control scheme.
3. Stable output over temperature from 32 degrees F (0 degrees C) to 104 degrees F (40 degrees C).
4. Partially shielded for accurate detection of available daylight to prevent fixture lighting and horizontal light component from skewing sensor detection.
5. Provide linear response from 0 to 10,000 footcandles.
6. Color: White.
7. Mounting:

a. Provide surface mounting bracket compatible with drywall, plaster, wood, concrete, and compressed fiber ceilings.
b. Provide all necessary mounting hardware and instructions for both temporary and permanent mounting.
c. Provide temporary mounting means to allow user to check proper performance and relocate as needed before permanently mounting sensor. Temporary mounting method to be design for easy, damage-free removal.

8. Meets California Title 24 Requirements.

2.13 ACCESSORIES

A. Emergency Lighting Interface:

1. Product: Lutron Model LUT-ELI.
2. Provides total system listing to UL 924 when used with lighting control system.
3. Senses all three phases of building power.
4. Provides an output to power panels or digital ballast interfaces if power on any phase fails and sends all lights controlled by these devices to an emergency light level setting. Lights to return to their previous intensities when normal power is restored.
5. Accepts a contact closure input from a fire alarm control panel.

B. Provide power supplies as indicated or as required to power system devices and accessories.

2.14 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for Additional Requirements.

B. Factory Testing; Lutron Standard Factory Testing:

1. Perform full-function factory testing on all completed assemblies. Statistical sampling is not acceptable.
2. Perform full-function factory testing on 100% of all ballasts and LED drivers.
3. Perform factory audit burn-in of all dimming assemblies and panels at 104 degrees F (40 degrees C) at full load for 2-hours.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, except for mounting heights specified in those Standards.

B. Install products in accordance with Manufacturer's instructions.

C. Provide dedicated network between lighting management system computer and lighting management hubs.

D. Define each dimmer/relay load type, assign each load to a zone, and set control functions.

E. Sensor Locations:

1. Where Lighting Control Manufacturer Sensor Layout and Tuning service is specified in Part 2 under "DIGITAL-NETWORK LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS", locate sensors in accordance with layout provided by Lighting Control Manufacturer. Lighting Control Manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated. Where Lighting Control Manufacturer Sensor Layout and Tuning service is not specified, locate sensors in accordance with Drawings.

F. Ensure that daylight sensor placement minimizes sensor view of electric light sources. Locate ceiling-mounted and luminaire-mounted daylight sensors to avoid direct view of luminaires.

G. Lamp Burn-In: Operate lamps at full output for prescribed period per Manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

H. LED Light Engine/Array Lead Length: Do not exceed 100 feet (31 m).

I. System and Network Integration Consultation; Lutron LSC-INT-VISIT: Include as part of the base bid additional costs for Lighting Control Manufacturer to conduct meeting with Facility Representative and other related Equipment Manufacturers to discuss equipment and integration procedures.

1. Coordinate scheduling of visit with Lighting Control Manufacturer. Manufacturer recommends that this visit be scheduled early in construction phase, after system purchase but prior to system installation.

J. Identify system components in accordance with Section 260553.

3.2 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for Additional Requirements.

B. Manufacturer's Startup Services; Lutron Standard Startup Services:

1. Manufacturer's Authorized Service Representative to conduct minimum of two site visits to ensure proper system installation and operation.
2. Conduct Pre-Installation visit to review Requirements with installer as specified in Part 1 under "Administrative Requirements".
3. Conduct second site visit upon completion of lighting control system to perform system startup and verify proper operation:

a. Verify connection of power wiring and load circuits.
b. Verify connection and location of controls.
c. Energize lighting management hubs and download system data program.
d. Address devices.
e. Verify proper connection of panel links (low voltage/data) and address panel.
f. Download system panel data to dimming/switching panels.
g. Verify system operation control by control.
h. Verify proper operation of Manufacturer's interfacing equipment.
i. Verify proper operation of Manufacturer's supplied PC and installed programs.
j. Configure initial groupings of ballast for wall controls, daylight sensors and occupancy sensors.
k. Provide initial rough calibration of sensors; fine-tuning of sensors is responsibility of Contractor unless provided by Lighting Control Manufacturer as part of Sensor Layout and Tuning service where specified in Part 2 under "DIGITAL-NETWORK LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS".
l. Train Owner's Representative on system capabilities, operation, and maintenance, as specified in Part 3 under "Closeout Activities".
m. Obtain sign-off on system functions.

4. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.3 COMMISSIONING

A. See Section 019113 - General Commissioning Requirements for Commissioning Requirements.

B. Title 24 Acceptance Testing Service; Lutron LSC-SPV-DOC-T24: Include as part of the base bid additional costs for Lighting Control Manufacturer to perform lighting control acceptance testing in accordance with CAL TITLE 24 P6. Submit required documentation.

3.4 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for Closeout Submittals.

B. See Section 017900 - Demonstration and Training, for Additional Requirements.

C. Demonstration:

1. On-Site Performance-Verification Walkthrough; Lutron LSC-WALK: Include as part of the base bid additional costs for Lighting Control Manufacturer to provide on-site demonstration of system functionality to Commissioning Agent.

D. Training:

1. Include services of Manufacturer's Authorized Service Representative to perform on-site training of Owner's Personnel on operation, adjustment, and maintenance of lighting control system as part of standard system start-up services.

a. Include training on software to be provided:

1) Configuration software used to make system programming and configuration changes.
2) Control and monitor.

3.5 MAINTENANCE

A. See Section 017000 - Execution and Closeout Requirements, for Additional Requirements relating to maintenance service.

B. Software Maintenance Agreement; Lutron LSC-SMA: Include as part of the base bid additional costs for Manufacturer to provide quarterly compatibility testing results for PC-based lighting control software and new patches issued for Microsoft Operating System, Database, and Browser tools.

1. If new Microsoft patches create a software conflict, Manufacturer to provide lighting control software patches to ensure continued operation.

C. System Optimization Visit; Lutron LSC-SYSOPT: Include as part of the base bid additional costs for Lighting Control System Manufacturer to visit site 6-months after system start-up to evaluate system usage and discuss opportunities to make efficiency improvements that will fit with the current use of the facility.

END OF SECTION 260943
040119/212227

Blank Page

SECTION 261005 – POWER DISTRIBUTION (OVER 600 VOLTS)

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other Sections for work related to those other Sections and required to be included as work under this Section.
2. General Provisions and Requirements for electrical work.

B. Additional Requirements for Conductors and Raceways of Circuits Greater than 600 volts.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Submit Product Data Sheets for all Wire, Conduit, Fittings, Splicing, and Terminating Materials.

B. Submit Material List for all Conduit and Fittings.

C. Perform Factory High Voltage AC and DC and Corona Level Conductor Tests per ICEA Standards on each length of cable. Submit Certified Reports of Factory Tests, together with all data necessary to determine that cable is as specified, including type of conductor, AWG size and stranding; type and thickness of insulation and jacket; type of shielding; insulation resistance constant corrected to standard temperature; voltage rating. Use standard ICEA terminology in reports.

D. Submit the AEIC Qualification Test Reports Data.

1.3 FACTORY TESTING

A. Final Testing on Shipping Reel

Each completed length of conductor shall be subjected to a 1-minute AC test voltage prior to shipping after the conduction’s have been placed on the shipping reels. AC test voltage shall be 25kV for 5/8kV insulated conductors and 34kV for 15kV insulated conductors.

B. Conductors, which fail the specified Factory Tests, are unacceptable and shall not be used. Submit eight copies of Factory Test Reports for review. Conductors shall not be installed until the Architect has reviewed the Factory Test Reports.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. General

1. Cables conductor sizes and quantity as indicated on Drawings.
2. Cable shall be in compliance with the latest applicable Requirements of UL, OSHA, NEMA, NEC, ASTM, AEIC and ICEA for installations indicated.
3. All cable must have been manufactured within 1-year of award of Contract. As manufactured by Okonite "Okoguard-Okoseal"; or Prysmian Cable Systems; or Kerite Company.
4. The following minimum information shall be factory imprinted on the cable jacket, a minimum of 36-inches on center.

    a. Manufacturers name.
    b. Insulation type and voltage level.
    c. Date of manufacture.
    d. Conductor size and material.
    e. Jacket type.

5. Cable shall be shipped and stored on cable reels and cable ends shall be sealed water-tight at all times. Cables not so shipped, stored and sealed shall be rejected.
6. The cable shall be rated 105 degrees C for normal operation, 140 degrees C for emergency overload operation, and 250 degrees C for short circuit conditions.
7. UL listed as type MV-105 per UL-1072.
8. Jacket shall be oil resistant, complying with “Oil Resistant-1” and “Oil Resistant-2” UL 1072.

B. Power Cable Construction (Phase to Phase System Operating, Voltage, 2000 volt thru 5000 volt.)

1. Conductor – single conductor copper, Compact Stranded per ASTM B496, ICEA S-68-524, NEMA WC-8 and UL-1072.
2. Conductor Strand Screen – continuous extruded layer over the conductor per ICEA S-68-516, AEIC CS-6, NEMA WC-8, and UL-1072.
3. Insulation – continuous Ethylene Propylene Rubber (EPR). 115 mil for 8 KV 100% insulation level, 5KV 133% insulation levels. Extruded over and bonded to conductor strand screen meeting or exceeding ICEA S-68-516, NEMA WC-8, AEIC CS-6, and UL 1072.
4. Insulating Screen – continuous, extruded, semi-conducting screen over the insulation meeting or exceeding ICEA S-68-516, AEIC CS-6 and UL-1072.
5. Shield – 5-mil copper tape shield applied with not less than a 12.5% overlap and full 100% coverage over insulation screen. Per UL-1072, ICEA S-68-516, and NEMA WC-8 (shield shall be omitted on cable utilized as a neutral conductor).
6. Jacket – non-metallic black sunlight resistant PVC (polyvinylchloride) extruded over shield, per ICEA S-68-516, NEMA WC-8, and UL-1072.

C. Power Cables Construction (Phase to Phase System Operating Voltage 5001 volt thru 13000 volt).

1. Conductor - single conductor copper, Compact Stranded per ASTM B496, ICEA S-68-524, NEMA WC-8, and UL-1072.
2. Conductor strand screen - continuous extruded layer over conductor per ICEA S-68-516, AEIC CS-6, NEMA WC-8, and UL-1072.

3. Insulation - continuous Ethylene Propylene Rubber (EPR). 220 MIL for 15KV, 133% insulation levels. Extruded over and bonded to conductor strand-screen meeting or exceeding ICEA S-68-516, NEMA WC-8 AEIC CS-6, and UL- 1072.
4. Insulating screen - continuous, extruded, semi-conducting screen over the insulation meeting or exceeding ICEA S-68-516, AEIC CS-6, and UL- 1072.
5. Shield - 5-mil copper tape shield applied with not less than a minimum of 12.5% overlap and 100% coverage over insulation screen. Per UL 1072, ICEA S-68-516, NEMA WC-8.
6. Jacket - non-metallic black sunlight resistant PVC (polyvinylchloride) extruded over shield, per ICEA S-68-516, NEMA WC-8, and UL- 1072.

2.2 CONDUCTOR SPLICING AND TERMINATIONS

A. General

1. All material used shall be compatible with specific cable installed and shall be rated for 90 degrees centigrade normal operation, 130 degrees centigrade emergency overload operation, and 250 degrees centigrade for short circuit conditions.
2. Shall be in compliance with Manufacturer's standard recommendations. Splices shall be suitable for continuous immersion in water.
3. Splices and terminations shall meet Class-1 Requirements.
4. The splices and terminations shall match and be compatible with the respective cable type, insulation, shielding and jacket.
5. Ground cable shield at each splice and termination.

B. Splices - (Built-Up Tape Type, for Pvc Jacket Cables)

1. General

   a. Conductors shall be joined by "T" type, "Y"-type or inline (as applicable) compression, tinned copper sleeves connectors, installed with hydraulic "die" compression tool. Sleeves shall have chamfered ends, and cable stops to properly center on conductor. Ampacity equal to conductor. 3M- "Scotchlok", Burndy-"144 splice".

2. Built-up tape type for pvc jacket cables

   a. Individual splices shall be hand laid built-up self-vulcanizing, insulating tape, with stress relief. Splice kits as manufacturing by Kerite, 3M or Plymouth.

3. Polymeric cable splices kits:

   a. Heat shrink or mechanical preshrink (cold shrink) uniform cross section, with linear stress relief and dielectric insulating layers; metallic shielding across splice with ground lead out; overall jacket sleeve.
   b. Comply with IEEE 48 and 404; seal environmental to provide ANSI C119.2 water immersion test, latest revisions.
   c. Outdoor weather tight construction, anti-tracking ultraviolet solar radiation overall jacket protection. As manufactured by Raychem or 3M.

C. Terminations (Indoor built-up tape type, or polymeric termination kit for PVC jacket cables where cable terminator is not specified with equipment).

1. General

   a. Conductor shall be terminated with compression tinned copper seamless, barrel terminal lugs installed with hydraulic "die" compression tool. Terminal lug shall be 4-bolt spade lug type for bus connections or stud type for other locations. Burndy- "Hylug" or 3M- "Scotchlok".

2. Individual cable terminations shall be hand laid, built-up self-vulcanizing insulating tape with stress relief. Termination kits as manufactured by Kerite, 3M or Plymouth.
3. Polymeric cable termination kits:

   a. The incoming line feeders shall be provided with premolded insulated primary conductor termination kits. The termination kits shall conform properly to compatible with the conductors shown on the Drawings, including out of round cables as defined on AEIC and ICEA heat shrink or mechanical preshrink. The termination shall environmentally seal the cable jacket. Stress relief and feeder insulation shield grounding. Provide anti-tracking skirts on terminations.
   b. Provide 4-bolt copper spade lug cable connector compression connectors, and bolt each termination to respective phase lug landings. Grade 5 Hex head bolts and Belleville washers. As manufactured by 3M or Raychem.

4. Terminations shall comply with IEEE-48- (latest revision) Class 1 conductor terminations shall all be 15kV Class:

   a. AC withstand input (kV)..... 50
   b. DC withstands, 15-minute (kV)..... 75
   c. Partial discharge, minimum kV for 3pC or less..... 15.6
   d. BIL basic impulse withstand 1.2 x 50 micro seconds crest ..... kV (outdoor) 110
   e. BIL basic impulse withstand 1.2 x 50 micro seconds crest kV (indoor) 95
   f. Continuous current rating (normal, overload, emergency) .....equal to connected cable
   g. Nominal overall length (inch)..... 15.5
   h. Wet withstand, 10 seconds (kV rms) 45
   i. Dry withstand, 6 hours (kV rms) 35
   j. To match connected cable and type.

5. Provide a minimum of two conductor cable landings for each incoming line phase termination.
6. Provide removable, electrically insulated, "boots" to completely cover each termination connection bolted lug landing and bus connection.
7. Primary cable supports shall be provided to eliminate any strain on cable terminations.

2.3 SEPARABLE INSULATED CONNECTOR, ELBOW CABLE TERMINATORS AND APPARATUS BUSHING WELLS

A. General

1. Separable insulated connector system cable terminators shall be non-load break, molded thermoplastic and molded rubber 200 amp for wire sizes smaller than 4/0 AWG, 600 Ampere for wire sizes 4/0 AWG and larger, unless noted otherwise on Drawings.

    a. De-energized dead-break bolted connects, unless noted otherwise on Drawings.

2. Assemblies shall be rated for continuous submersion in 10 feet of water.
3. Provide terminators to accommodate the connecting feeder cable type and size.
4. Insulated, shielded, dead front, safety plug, one for each cable phase, complying with ANSI C119 and 386 latest revisions. Shall be designed, manufactured, and tested to comply with IEEE-386 and IEEE-592 latest revisions. Suitable for "insulated-hook-stick" insertion and removal.
5. Elbows and apparatus bushing wells shall be mechanically and electrically compatible. Shall be inter-changeable operation between multiple Manufacturers.
6. Provide "parking" stands for each termination and phase, in each location.
7. As manufactured by G & W Electric; or Elastimold/Thomas & Betts.

B. Electrical Ratings

	System Voltage Electrical Ratings	System Voltage 2400V or 4160V	above 4160 volt to 13000 volt
1.	Line to ground rating	8.3kV	15.2kV-RMS
2.	Impulse withstands voltage BIL.	95kV-RMS	125kV
3.	Withstand voltage, 60Hz AC	34kV-RMS	40kV-RMS
4.	Withstand voltage D.C. 15 minute	53kV D.C.	78kV D.C.
5.	Corona Extinction	11kV D.C.	19kV D.C.
6.	200 amp elbow - momentary withstand for 10Hz	10,000AMP-Sym.	10,000AMP-SYM
7.	600 amp elbow – momentary withstand for 10Hz	18,000 Sym.	18,000 Sym.
8.	Continuous load current	200AMP-RMS (600 AMP-RMS)	200AMP-RMS (600 AMP-RMS)

C. Elbow Connector Test Point

1. Each elbow shall be provided with front accessible capacitive coupled test point.
2. The test point shall include a protective, removable, voltage insulated, snap-in cap to provide test point access.

D. Fault Indicator

1. Provide a fully automatic, capacitance coupled electrical, visual fault indicator installed in each test point.
2. Self-powered through capacitive coupling when installed in the elbow test point.
3. The fault current indicator pick-up current and operating speed shall be selected based on upstream relay/fuse types and settings, for correct fault indicates. Additionally, it shall prevent false fault-indication caused by normal motor, transformer and conductor charging in rush (turn-on) currents.

E. Multi-Point-Junctions

1. Shall distribute primary voltage multiple circuit taps for separable elbow-connectors. Modular, premolded, insulated, with internal 600 ampere single phase copper distribution bus.
2. Provide quantity of multiport connector ports on each junction for multiple insulated separable elbow connector attachments, plus spares. Electrical characteristics and insulation characteristics shall match the elbow connectors.
3. Fully shielded and fully insulated and fully submersible in water when energized.
4. 304 – stainless steel surface mounting brackets with ground lug. Provide two integral (left-right) "parking" stands for elbow connectors.
5. Provide bushing inserts for electrical and mechanical compatibility with respective elbow connectors.
6. Provide not less than three multi-point-junction assemblies at each location; Phase-A, Phase-B, and Phase-C. Provide not less than two additional spare connection ports on each multi-point-junction assembly for future use.
7. Interface spacing between ports shall be uniform and compatible with respective elbow connectors.

2.4 CONDUIT (ADDITIONAL REQUIREMENTS)

A. Aluminum Conduit, Flexible Metal or Non-metal Conduit and Electrical Metallic Tubing shall not be used.

B. Rigid Galvanized Steel Conduit shall be used for all exposed and concealed conduit above grade and for bends and risers below grade.

C. Nonmetallic Conduits Schedule 40 PVC or type "EB" shall be used for all ducts below grade, and shall be completely concrete encased in a 3-inch concrete envelope the entire length, including below building slabs.

D. Bury Underground Conduit a minimum of 36 inches to top of concrete encasement below final finish grade, including under building slabs.

E. Provide End Bells on All Conduit Terminations.

F. Condulets shall not be used.

G. Provide Molded, Snap Together, Conduit Support Spacers a minimum of 5-feet on center in all underground multiple conduit installations.

The spacing between conduits located below grade shall be as follows:

1. Two inches between conduits for circuits operating above 600 volts.
2. Six inches between conduits for circuits operating above 600 volts and conduits for circuit operating below 600 volts.
3. Twelve inches from conduits for any Utility Company circuits and pipes.

2.5 FIREPROOFING

A. The Cable Fireproofing shall consist of a hand applied flexible tape, conformable fabric coated with flame retardant and separate securing tape wrap. As manufactured by 3M or Plymouth.

B. The Tape shall be a flexible polymeric coating and/or chlorinated elastomer not less than 0.03 inch thick, weighing not less than 2.5 pounds per square yard.

C. The Tape shall be non-corrosive to the cable jacket.

D. The Tape shall be self-extinguishing shall not support combustion, and shall withstand high current fault ARC temperatures of 13000 degrees Kelvin for 70Hz.

E. The Tape shall not deteriorate when subjected to oil, water, salt water, sewage and fungus.

PART 3 - EXECUTION

3.1 CONDUCTORS IN RACEWAYS

A. Conduit Preparation

1. Metallic conduit shall be reamed and cleaned to remove metal cuttings, fillings and cutting oil.
2. Rod all underground raceways, including existing raceways to be used under this Contract, with approved test and flexible mandrels to remove all obstructions. Use test mandrels at least 12-inches long, ¼-inch less than diameter of duct at center, tapering to ½-inch less than duct size at ends. Do all cleaning and testing in the presence of Owner's Representative.
3. If test mandrels cannot be pulled through Raceways Contractor shall perform the following to clear the raceways.

    a. Force rigid or semi-rigid rods through the raceways to clear the obstructions from one or both ends of the raceway.
    b. Force a power driven rotating router device with small diameter cutting blades, in incremental stages to a cutting blade diameter approximately ⅛-inch smaller than the raceway inside diameter.

    After clearing the raceway of obstructions pull a test mandrel or brush through the raceway to clear the remaining debris from the raceway.

B. Cable Lubrication:

1. Cable pulling lubricants shall be specifically approved by the Cable Manufacturer. The following lubricants shall be used where approved by the Cable Manufacturer.

    a. Slip X -300, American Colliod Co.
    b. Bishop #45, Bishop Electric.
    c. MacLube CA51, MacProducts.
    d. Minerallac H2B,- Minerallac Electric.
    e. Winter grade #7437-PC, General Machine Products.
    f. Gel-lube 7/5, Cable associates.
    g. Polywater, A, C, G - American Polywater.

2. Lubricants shall be continuously applied as cable enters raceway.

C. Pulling Tensions "EPR" Insulation PVC Jacket, Copper Conductors.

1. The maximum pulling-in tensions and stresses on the cable must not exceed the undermentioned values when pulling the cable.

    a. The maximum pulling stress in pounds (tension), shall not exceed 0.008 times the CM (Circular Mil) area of the conductor when pulled with a pulling eye attached directly to each copper conductors, (i.e. (500,000 MCM) x (.008) = 4000 pounds).
    b. The maximum pulling stress shall not exceed 1000 pounds for non-leaded cables when pulled with a Kellums or Greenlee type basket grip on each conductor but in any case shall not exceed item (a) above.
    c. The cable sidewall pressure shall be defined as the pulling tension on the cable out of a bend, expressed in pounds divided by the radius of bend expressed in feet. The maximum cable side wall pressure (pulling tension) in pounds shall not exceed 400 times the raceway bend radius in feet. But in any case shall not exceed ‘a’ and ‘b’ above (i.e. (4 feet conduit radius) x (400) = 1600 pounds maximum pulling tension at the 4 feet conduit bend).
    d. Pulling tension calculations shall be submitted to ENGINEER prior to pulling any cable, for each cable run in excess of 100 feet and/or 180 degrees in bends. Similar runs need not be recalculated (i.e. same quantity and type of bends and/or length).

2. A dynamometer to measure pulling tension shall be used on all cable runs in excess 200 feet or with more than 180 degrees in bends. The actual pulling tension value shall be calculated and recorded for each pull.
3. Pulling eyes on each conductor shall be used for cable runs in excess of 100 feet or more than 180 degrees in bends, between pull points.

D. The Minimum Radii to which the installed cables can be bent for safe electrical operation and without danger of physical damage to the cable insulation, metallic shielding tapes, and/or outer jacketing materials shall not be less than 12 times the diameter over the finished cable jacket. Bends shall not be made in splices or terminations.

E. Installation

1. Do not pull conductors until factory test reports have been submitted and reviewed.
2. The attachment of the pulling device to the conductor pulling eyes or basket grips shall be made through a swivel connector.
3. The attachment of pulling devices directly to the cables shall be with individual basket grips over each cable jacket or individual pulling eyes attached directly to each cable conductor. Securely tape cable ends to prevent moisture or pulling compound from penetrating cable.
4. The Contractor shall ensure that the high voltage cables are fed straight into the raceway taking care to avoid short bends, sharp edges and cable "cross-overs".
5. All lashings used for temporary bunching of the individual cables shall be removed before the cables enter the raceway. Lead-out the cables at all manholes, pullboxes and conduits taking care to feed them in again by hand for the next run. Cables shall not be pulled directly around a short right angle bend.
6. For each cable pull where a cable direction change is required flexible feed-in tubes, pull-out devices, multi-segmented sheaves etc. shall be used to insure proper cable pulling tensions and side wall pressures. Any device or surface the cable comes in contact with when under pull-in tension shall have a minimum radius 50% greater than the final specified minimum installed cable-bending radius. The maximum possible size radius sheaves and feed-in tubes, usable in the available working space, shall be provided in all situations, to insure the minimum possible cable sidewall pulling pressure. Do not use devices with multi-segment "roller" type sheaves.
7. Cable lengths over 50 feet shall be machine pulled not hand pulled. Cables shall be pulled in a continuous, smooth operation without jerking or stop-start motion after initiation of pull. Maximum cable pulling speed shall be less than 50 feet per minute. Minimum cable pulling speed shall be greater than 15 feet per minute.

8. Cables shall be pulled straight into or out of the raceway without bends at the raceway entrance or exit. Pull in cable from the end having the sharpest bend (i.e., bend shall be closest to reel). Keep pulling tension to minimum by liberal use of lubricant, hand turning of reel, and slack feeding of cable into duct entrance. Employ not less than one man at reel and one at manhole or pullhole during this operation. Cables shall be pulled directly from cable reels.
9. Cables shall be trained or racked in trenches, vaults, manholes and pull boxes with consideration given for the minimum specified bending radius of the cable and the possibility of cable movements due to load cycling. The cables shall be racked and supported in such a manner that adequate space is allowed for splicing and the cables shall always be fanned out from the duct or conduit so as not to cross other ducts conduits or cables. To prevent damage from falling objects or Personnel entering the manhole the cables shall not pass directly under the manhole opening.
10. Cable shall be supported in manholes; pull boxes and vaults a minimum of 18-inches on center with cable racks. Provide hot dip galvanized T-slot racks and support arms. Secure cables to racks with porcelain supports for each cable on the racks. Loosely lash cables to racks. Splices shall be directly supported, on racks. Do not install cables more than one feeder on the same rack hook.
11. Cables shall be routed the long way around manhole, pullhole, etc. unless noted otherwise.
12. Existing conductors shall be protected at all times when Contract Work occurs in the same area, including but not limited to pullboxes, vaults manholes, cable trenches etc. Provide temporary electrical insulating blankets and barriers over existing conductors to reduce the possibility of accidental mechanical damage to existing conductors.

F. Movement, Storage, and Handling of Cable

1. Reels of cable shall not be dropped from any height, from trucks or other transporting equipment.
2. Lift and move cable reels using following methods:

    a. Crane or boom type equipment-insert shaft (heavy rod or pipe) through reel hubs and lift with slings on shaft, with spreader or yoke to reduce or avoid sling pressure against reel head.
    b. Forklift type of equipment may be used to move smaller, narrower width reels. Fork times should be placed so that lift pressure is on reel heads, not on cable, and shall reach all the way across reels so lift is against both reel heads.
    c. Reels may be moved short distances by rolling. Reels shall be rolled in the direction indicated by arrows painted on reel heads. Surfaces over which the reels are to be rolled shall be solid clear or debris, and also clear of protruding stones, humps, etc. which might damage the cable if the reel straddles them.

3. Storage of Reels of Cable

    a. Cable ends shall be sealed prior to shipment to prevent moisture entry into cable. Cable ends shall remain sealed at all times including during installation. Where ends seals are removed, reseal cable ends by stripping cable finishes back 2-inches down to insulation. Then apply four layers of an insulating tape criss-cross over the cable end and carry back at least 4-inches onto cable outer finish. Add a containing cover of two layers of vinyl electrical tape completely over the end seal.
    b. Cable reels shall be shipped with factory applied lagging (protective cover) left in place until removal is absolutely necessary. Additional covering such as tarpaulin, plastic sheeting, etc. shall be used if cable is to be stored outdoors.
    c. Store reels of cable on a firm surface, paved, or on planking to prevent settling into soft ground.
    d. Use fencing or other barriers to protect cables and reels against damage by vehicles or other equipment moving about in the storage area.

G. Cable Testing

1. Contractor shall have an independent Testing Laboratory perform a high voltage DC acceptance test on each phase or leg of cables in accordance with ICEA Standards S-19-81, latest revision. Certified Test Reports shall be submitted to Engineer in the form of time versus current graph showing initial leakage current after test voltage is applied and for each 15 second interval up to 1-minute and for each one minute interval thereafter. Each graph shall be identified to correspond with the Cable Section and feeder name. Information on temperature, humidity and type of test equipment used during test shall also be submitted.
2. Cables shall be tested as follows:

    a. Each segment and phase shall be tested after installation and prior to splicing or terminating to other equipment or cables.
    b. Each conductor feeder and phase shall be tested after splicing to other new cables is completed, and prior to connection to equipment or other existing cables.
    c. Do not perform D.C. high voltage cable acceptance test into existing conductors, new or existing equipment, connected to the cables being tested.

3. Certified Factory Test Reports performed in accordance with ICEA S-19-81, Tables 2-12 and 6-17. Corona and AC/DC Tests shall be submitted with Shop Drawings for the specific cable to be installed.
4. Field test procedure:

    a. Set up test equipment. Do not connect test lead to cables, but temporarily hang the lead free with a plastic bag over the clip. Raise the voltage to the same final level as the cables test voltage. The leakage current seen on the DC meter is leakage in the test lead, and shall be subtracted from the readings taken later during the cable test. Shut the set off and discharge the lead.
    b. Apply the test voltage to each phase separately, making sure that all other phases, all cable shields, any armoring or neutral conductors, and other nearby metallic objects are grounded to prevent voltage pick-up.
    c. Raise the test voltage from zero gradually in 10% steps to 80% of the final test voltage, then in 5% steps to final test voltage, which shall be left on for 5 minutes. Take current readings at each step after current has been stabilized approximately 1-minute intervals. Take current reading each minute period. Record each step volt-age/current and time interval. Plot readings on graph paper.
    d. During the test if a breakdown is indicated by a sudden or continuous increase in current, de-energize, disconnect and isolate the trouble. Remedy problem, completely disassemble and redo any defective cable terminations or splices. Retest cable, if breakdown is again indicated, remove, discard and replace defective cable and retest replacement cable. Defective cable shall be removed from site and shall not be reused.
    e. Upon completion of a successful test, shut down the test set and allow the voltage to decay to one-fourth the full value. Record the decay time.
    f. Solidly ground the conductor and allow the ground to remain in place for a period at least as long as the test time.
    g. Repeat the same test sequence for each phase cable and cable section.
    h. Proper precautions shall be taken to eliminate "end corona" during the test procedure. The leakage currents and the voltage decay times should be fairly similar for the individual phases of the same cable circuit. Also, a graphic plot of the current versus voltage values of the step-rise test should show a reasonably straight line (equal increments of current rise for equal increments of voltage increases), the current readings always being taken after the same duration of time (one minute) after reaching each voltage level. To insure proper testing procedures the Contractor shall do the following:

        1) The cable ends (or terminations) are clean and dry.
        2) The cable or terminal ends are as far away from surrounding structures as practical.

3) The creepage distance from conductor back to cable shield is at least 1-inch for each 5kV of test voltage (this applies to newly installed cable, which has not yet been terminated).
4) The irregularly shaped clip or connector where the test lead joins to the cable is wrapped with a few layers of plastic sheet to form a smooth tube to reduce corona.
5) The free ends of cable have a glass jar or plastic bag over the end to reduce corona.

i. The final D.C. test voltages for shielded cable shall be 30kV for 5kV or 8kV cable and 56kV for 15kV cable.

3.2 ARC PROOFING (FIREPROOFING)

A. All Wires and Cables which will carry current at 600 volts or more in manholes, pullboxes, and vaults shall be fireproofed.

B. Strips of Fire Proofing Tape approximately 1/16 inch thick by 3 inches wide shall be wrapped tightly around cable spirally in wrapping. The tape shall be applied with the coated side toward the cable and shall extend one inch into the ducts. To prevent unraveling, the fireproofing tape shall be spirally "Half-Lap" wrapped the entire length of the cable.

C. Fire Proofing shall be applied separately on each individual conductor. Secure fire proofing with two layers of spirally wrapped glass cloth electrical tape.

3.3 CABLE SPLICES AND TERMINATIONS

A. Cable Splicing and Terminations shall be performed by Personnel with a minimum of 5 years-qualified experience with specific splicing and termination methods used. Submit letter-certifying qualifications.

B. Each Conductor shall be spliced in each manhole and pullbox whether or not shown on the Drawings. No splices or terminations will be allowed in conduit or ducts.

C. Cable Shield shall be brought out and grounded at each splice and termination point to the equipment bond grounding system.

D. Splices (Built-Up Tape Type for PVC Jacket Cables)

1. Cables shall be striped, tapered rasped with creepage distances per Manufacturer recommendations. Apply fill sealing putty on conductor compression sleeve indents and conductor, prior to beginning of splice taping.
2. Conductor compression connectors shall be crimped with tools and specifically designed for the connector.
3. Apply tape over conductor and connector sleeve.
4. Apply splicing cement to rasped insulation and insulation screen.
5. Apply insulating tape.
6. Apply friction tape over insulation tape.
7. Apply conducting fabric tape.
8. Apply open spiral of tinned copper wire braid to carry shield continuity across the splice. Tack solders to 5-mil copper shield tape on each side of splice an additional single ground braid. Ground braid shall be brought out at splice, minimum 18-inches long and connected to ground bonding conductor, bind down braid with friction tape.

E. Terminations (indoor built-up) Tape Type, for PVC Jacket Cables where cable terminator is not specified with equipment).

1. Cables shall be striped tapered, rasped with creepage distances per Manufacturer recommendations.
2. Conductor compression connectors shall be crimped with tools and dies specifically designed for the connector.
3. Tack solder to 5 mil copper shield tape, tinned copper shield tape, Bind down with friction tape. Bring out approximately 18-inches of ground braid and connect to ground bonding conductor.
4. Apply sealing putty at tape shield/insulation joint and connector lug indents.
5. Apply insulating tape.
6. Apply friction and electrical tape.
7. Make lug seal applying insulating tape, friction tape and electrical tape.
8. Apply friction and electrical tape.

F. Polymeric Cable Splice Kits and Termination Kits

1. Install in strict compliance with the Manufacturer instructions.

3.4 IDENTIFICATION (ADDITIONAL REQUIREMENTS)

A. Each Cable and Cable Tap shall be identified with nametags in manhole pullboxes, terminations and vaults.

B. Identification Tags shall include the following information:

1. Feeder name as indicated on Drawings (i.e. HV1, F4, MSB3 etc.).
2. Conductor phase (i.e. phase A, or phase B, or phase C, or neutral).
3. Installation month and date (i.e. 3/85, 4/78 etc.).
4. Conductor size conductor type (copper or aluminum) and insulation type (i.e. 4/0 CU-EPR, 500 AL VCL, etc.).
5. Insulation voltage (i.e. 5kV, 8KV, 15kV, etc.).
6. Feeder taps to equipment or building shall also be identified with equipment name or building (i.e. library, SW1, XMRA, etc.).

C. Tags shall be ⅛-inch thick 98% lead, approximately 2-inches square with chamfered corners. Two holes shall be drilled for attachment to primary cable. Lettering shall be ⅛-inch high, engraved or die stamped. Attach tags to primary cables with two #14 AWG (THWN insulated) solid copper conductors "twist-tied", with insulated CAP wire-nut on the tie-wire ends, to cover sharp edges of tie-wire conductor.

D. Alternate Identification Tags, at the Contractor's option in lieu of lead tags. Provide polypropylene tag holders with interchangeable, yellow polypropylene tags with black alphanumeric characters sets. Characters shall be a minimum of 0.25-inch high. As manufactured by Almetek industries "EZTAG" - Ledgewood, New Jersey, William Frick & Co. - Vernon Hills, ILL.

E. Hot-Phasing

The Contractor shall perform and certify phase rotation testing on connections to existing / new circuits and equipment. Testing shall verify equipment and conductors are correctly "Hot-Phase" sequenced, to allow interconnecting and inter switching of any "Hot" circuits of like voltage with correct phase sequencing. The Contractor shall correct any phasing sequence found to be incorrect as a result of work performed by this Contract.

3.5 GROUNDING ADDITIONAL REQUIREMENTS

A. Raceways

1. Provide all raceways and conduits containing circuits operating at line to line or line to ground voltages exceeding 600 volts with an internal dedicated equipment ground/bond wire, copper conductors, 600 volt insulation.
2. Typical for metallic and non-metallic raceways and conduits.

B. Splices and Terminations

1. Provide cable shield ground/bond lead out at each conductor splice and termination location. Extend and connect to respective equipment ground bus; each pull box/manhole respective ground rods and feeder ground conductors; etc.

END OF SECTION 261005
040119/212227

This page is blank.

SECTION 262413 - SWITCHBOARDS

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other Specification Sections and Drawings for related work required to be included as work under Division 26.
2. General Provisions and Requirements for electrical work.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Provide Schematic "Ladder Type" logic control wiring diagrams and "point-to-point control wiring diagrams showing control and protective systems interlocks.

B. Provide Nameplate Engraving Schedule.

C. Submit Full-Scale Time/Current Transparencies on log/log paper for all fuses, circuit breakers, ground fault system devices, and relays. Additionally, provide software to generate time/ current curves of each circuit protection device.

D. Short Circuit, Coordination and Arc-Flash

1. Perform and submit engineered settings for each equipment location, fuse and circuit breaker device, showing the correct time and current settings to provide the selective coordination within the limits of the specified equipment, per the latest applicable Standards of IEEE and ANSI. Provide electrical system short circuit fault analysis, both 3-phase line-to-line and 1-phase line-to-ground calculations as part of the coordination analysis recommendations. Provide Electric Arc-Flash calculations as part of the coordination analysis recommendations.
2. The information shall be submitted in both tabular form and on time current log-log graph paper, with an engineering narrative. Written narrative describing data, assumptions, analysis of results and prioritized recommendations, six copies.
3. The goal is to minimize an unexpected but necessary electrical system outage and Personnel exposure to the smallest extent possible within the fault occurrence location, using the specified contract equipment. Shall comply with, but not limited to:

    a. IEEE-242, Recommended Practices for Protection and Coordination of Industrial and Commercial Distribution.
    b. IEEE-399, Recommended Practice for Industrial and Commercial Power System Analysis.
    c. IEEE-1584, Guide to Performing Arc-Flash Hazard Calculations.
    d. CEC/NEC

4. Electrical equipment including switchgear, switchboards, electric panels and control panels, motor control centers, combination motor starters, transformers, disconnects, etc., shall each be labeled by the

Manufacturer with "Electric-Arc-Flash" warning signs. The signs shall explain a hazard to personnel may exist if the equipment is worked on while energized or operated by personnel while energized. The sign shall instruct personnel to wear the correct protective equipment/clothing (PPE) when working "Live", or operating "Live" electrical equipment and circuits.

5. The Contractor shall independently contact the serving Utility Company to obtain the current system short circuit amps or available fault current.
6. The Contractor shall independently obtain As-Built Drawings for the existing infrastructure to establish lengths. If As-Built Drawings are no available, the Contractor shall research existing conditions and make reasonable but conservative estimates of conductor length. Where existing conductors have been re-used, the Contractor shall confirm conductor quantity, size, and conduit type.

E. Factory Tests: Equipment tests - ANSI C37.20. Certified copies of design tests, production tests, and conformance tests of the equipment shall be submitted and review comments shall be received before delivery of equipment to the project site. In lieu of the above tests, a report of these tests previously performed on identical units of each rating will be acceptable.

1.3 APPLICABLE STANDARDS

A. The Switchboard and switchgear equipment shall be designed, tested and assembled to comply with ANSI, IEEE, and NEMA and UL.

B. Seismic Earthquake and Wind Loading Withstand, Testing and Certification (Additional Requirements).

1. The complete switchboard/switchgear assembly; including circuit protection devices, meter, housings/ enclosures, accessories, supports/anchors etc., shall be designed, manufactured and tested.

    a. Wind loading all outdoor equipment locations.
    b. Earthquake Seismic Requirements of CBC/IBC Seismic withstand all indoor and all outdoor equipment locations.

2. Shall withstand, survive and maintain continuous non-interrupted energized operation during the seismic event occurrences and wind event occurrences. Continued normal energized operation after the wind event and seismic event occurrences have abated.
3. Shall include demonstrations of successful operation and run test after completion of seismic event shake-table simulation. Acceptance test seismic qualification of proposed switchboard and/or switch-gear shall employ triple axis shake-table simulation of the Required Response Spectrum (RRS) seismic event motion, certified and approved by the AHJ.
4. Provide three dimensional finite element analysis demonstrating anchorage and operational withstand of wind loading not less than as follows and as required by AHJ:

    a. 110MPH-West Coast USA, California, and Hawaii, per ASCE/SEI 7-10.

5. Seismic test shall be performed by a third party independent Test Laboratory. Wind Analysis and Seismic Testing and reports shall be certified, signed and "Stamped" by PE Professional Engineer licensed and in good standing in the State, Civil Engineer or Structural Engineer.

C. Equipment components/devices, switchboards, and/or switchgear shall be manufactured by: General Electric; or Cutler-Hammer; or Square–D; or Siemens.

PART 2 - PRODUCTS

2.1 BUSSING

A. Horizontal and vertical busses shall be full lengths in each Equipment Section. Buses shall have a minimum short circuit fault withstand rating equal to available fault current indicated on Drawings, plus a 25% additional capacity (safety margin). However, in no case shall the rating be less than 50,000-amp, symmetrical.

B. Provide interconnected full capacity neutral bus in each Section with the same ratings and construction as the phase busses.

C. Provide interconnected ground bus in each Section.

D. Provide space and all hardware and mounting attachments for future devices as indicated on the Drawings.

E. Main horizontal phase and neutral bussing shall be full capacity in all equipment sections. The through bus of the end distribution section shall be extended and pre-drilled to allow the addition of future Sections.

F. Vertical riser buss may be tapered, to not less than one third the ampacity rating of the main horizontal buss; but in no case shall the vertical buss be of less capacity than the sum of the frame size ampacities of over-current devices mounted in the respective sections including any indicated spares and spaces.

G. The equipment bussing shall be of sufficient cross-sectional area to meet UL Standard 891 on temperature rise Bus shall be copper with silver plated bus joints or extruded aluminum with tin plated bus joints. The through bus shall have provisions for the addition of future sections. The through bus supports, connections and joints are to be bolted with Grade 5 hex head bolts and Belleville washers to minimize Maintenance Requirements.

2.2 CIRCUIT BREAKERS

A. General

1. Circuit protective devices as indicated on the Drawings. All devices shall have a short circuit interrupting capacity not less than the maximum available fault current at the circuit breaker and as indicated on the Drawings, plus a 25% additional capacity (safety margin). However, in no case shall the circuit breaker interrupting capacity be less than 30,000 amp symmetrical interrupting for 480/277 volt devices and 42,000 amp symmetrical for 240 volt or 208/120 volt devices.
2. Provide padlock-off devices on each device. Breakers shall provide automatic time over-current and instantaneous circuit protection. Shall be suitable for use as “Main” service disconnect, “Feeder” and “Branch-Circuit” functions.
3. Circuit breakers shall employ a self-powered stored energy, quick make-quick break, and trip free operating system on each phase, with common trip. Circuit breakers shall not trip in the event of short term or long term electrical power failure. Dead front cover accessible close-open controls, monitors and visual indicator flags.
4. Circuit breakers noted as "100%" on the Drawings shall be tested and rated to carry the breaker full rated (100%) ampere load continuously including the assemblies the circuit breakers are installed into.
5. Provide conductor lugs for circuit protection devices to accept conductor temperature rating, sizes and quantities shown on Drawings. Circuit protection devices shall be UL listed suitable for normal and reverse feed.
6. Provide auxiliary contacts on circuit breakers. Auxiliary “DRY” contacts shall provide supervised remote monitoring of “Open-Close-Trip” circuit breaker status. Typical for circuit breakers supplying the following types of connected electrical loads.

    a. Fire alarm equipment and devices.

b. Mass-evacuation equipment and devices.
c. HVAC smoke control and smoke evacuation equipment.
d. HVAC fire/smoke electrically operated dampers.
e. Intrusion detection and access control equipment and devices.
f. Elevators and escalators.
g. Fire sprinkler pumps.

7. Plug-in communications port for circuit breaker portable test instrument connects.
8. Circuit breaker data monitoring and communications:

   a. The circuit protection devices shall monitor, communicate and report circuit voltage, ampere, power, and harmonic parameters for the respective connected circuit. The circuit protection device monitor and communication parameters shall be the same and compatible with the specified "METERING" devices.
   b. Additionally the circuit protection devices shall monitor and communicate the respective device status as follows:

      1) Open/close/trip device status
      2) Ground fault trip status (where applicable)

   c. Provide circuit breaker data monitoring and communications for each of the individual feeder protection devices and main protection devices located in switchgear and switchboards, rated 400 amp or greater trip rating.
   d. The respective "METER" display selection control functions shall provide selection and display of all information monitored and communicated by individual protection devices on the respective meter alphanumeric display.

9. Circuit breakers shall be Power Circuit Breaker type, Insulated Case Circuit Breaker type or Molded Case Circuit Breaker type. Time/current and instantaneous characteristics and selection of circuit breaker type shall comply with the recommendations in the coordination study and insure optimal Code mandated time/current and instantaneous coordinated sequential tripping throughout the electrical system.
   The Contract Document intent requires providing the selection and use of the circuit breaker types and performance characteristics for time/current and instantaneous trip coordination during electrical circuit overload conditions and during electrical short circuit fault conditions. Combined with the specified circuit breaker protection time/current performance characteristics.

   a. Insulated Case Circuit Breaker type-ICCB:

      1) NEMA-AB1 and AB3, comply with latest revision.
      2) UL-1087, UL-489 and IEC-60.947, comply with latest revision.
      3) 5Hz AC closing and 3Hz AC trip and clear.
      4) Hybrid combination of Molded Case Circuit Breaker type and Power Circuit Breaker type circuit breakers. ICCB enclosed insulated housing and limited internal maintenance access.
      5) Two-step stored energy close mechanism.
      6) Extended function on-off instantaneous trip selection.
      7) Push-to-trip button.
      8) Mechanical operations counter.

   b. Molded Case Circuit Breaker type-MCCB:

1) NEMA-AB1 and AB3, comply with latest revision.
2) UL-1087, UL-489 and IEC-60.947.2 rated devices, comply with latest revision.
3) 5Hz AC closing and 3Hz AC trip and clear.
4) Sealed enclosed housing.

B. Protection Performance Requirements for circuit breakers conforming to one or more of the following applications:

- 600 amp or larger frame size.
- Larger than 400 amp trip.
- Service entrance in main switchboard or switchgear.
- Noted as Main or Main Circuit breakers on the Drawings.

1. Circuit breaker shall employ current sensors and solid-state static digital electronic automatic trip system. Three phase or single-phase operation as noted on the Drawings. Current carrying components shall be completely isolated from the static trip units. The trip unit shall be independent of external power sources. Circuit breakers shall be rated for reverse connection.
2. Circuit breaker solid state digital trip control functions shall provide the following time/ current curve shaping field adjustable features;

a. Adjustable ampere setting to vary the long-time continuous current carrying capacity, minimum range of 80% through 100% of full load trip rating.
b. Adjustable long-time delay setting to vary the time the breaker will trip under sustained over-load conditions. Minimum of three settings, "minimum - intermediate - maximum".
c. Adjustable short-time pickup to vary the level of high current the breaker can carry for short periods of time, minimum range of two times through eight times of ampere setting.
d. Adjustable short time delay to vary the time of the short-time pickup. Minimum of three settings "minimum-intermediate-maximum".
e. Short time "I^2t" switch to allow a current-squared multiplied by time ramp function in the short-time system. Two position setting "in-out".
f. Adjustable instantaneous pickup to vary the breaker ampere setting for immediate (instantaneous) interruption of severe overloads (short circuits). Adjustable minimum range of two times through nine times of circuit breaker ampere sensor rating. Instantaneous selective over-ride trip setting shall also include “on-off” function. When “off”:, or “override” is selected, shall then function with the adjustable short time delay and adjustable short time pick-up (Note where the coordination study requires a higher instantaneous setting, change the specified adjustable instantaneous trip to fixed instantaneous trip at fifteen times the breaker ampere sensor setting also with on-off function).
g. Individual fault trip indicators (flags) shall provide local indication on the breaker for overload and short circuit (and ground fault where applicable) conditions.
h. Provide quantity of one Manufacturer’s Standard Test set for solid state trip circuit breakers.

C. Protection Performance Requirements for circuit breakers conforming to one or more of the following applications:

- Smaller than 600 amp frame size.
- 400 amp and smaller trip.
- Larger than 100 amp frame size.
- Larger than 100 amp trip.

1. Circuit breaker shall employ current sensors and solid-state static digital electronic automatic trip system. Time/current curve shaping field adjustable features

2. Solid state digital trip breakers shall conform to the Requirements described above for solid state breakers larger than 400 amp trip. However, only the following field adjustments are required;

   a. Long-time ampere setting adjustable minimum range of 80% through 100% of full load trip rating.
   b. Short time pickup adjustable minimum range of two times through eight times of the ampere setting.
   c. Fixed or field adjustable instantaneous trip (depending on the results of the coordination study).

D. Performance Requirements for circuit breakers conforming to the following applications:

- 100 amp frame size and smaller.
- 100 amp and smaller trip.

1. Circuit breaker shall be fixed or adjustable instantaneous current trip with thermal-magnetic trip or with solid-state static digital electronic automatic time/over current automatic trip (depending on the results of the coordination study).

E. Current Limiting Circuit Breakers (CLCB)

1. Protection Performance Requirements for circuit breakers conforming to the following applications:

- 600 amp and smaller trip and identified as current limiting (CLCB) in the Contract Documents.

   a. Current limiting circuit breakers shall be supplied in integral fully enclosed insulating housing construction and shall consist of a common trip, thermal-magnetic or solid state static digital trip conventional circuit breaker (Depending on the results of the coordination study), with an independently operating limiter section in series with each pole.
   b. The conventional breaker section shall have an over center, trip-free, toggle-type mechanism with quick-make, quick-break action and positive handle indication. A button shall be provided on the cover for mechanically tripping the circuit breaker. The current limiting breaker shall have permanent trip units containing solid state static digital trip or individual thermal and magnetic trip elements, in each pole. Calibrated for 40-degrees C ambient temperature. The limiter section shall consist of current limiting elements on each phase, electrically coordinated with the conventional circuit breaker trip elements. The contacts of the limiter section shall be electro-magnetically and electro-dynamically opened and held open until interruption is complete.
   c. Current and Energy Limitations: On high-level fault currents the limiter portion of the circuit breaker shall operate to limit the rise of fault current. Integral resistance shall be introduced into the faulted circuit to dissipate and limit let-through energy and to provide a voltage transient-free interruption at near unity power factor. The Let-through short circuit fault current and energy levels shall be less than that permitted by Underwriters Laboratories to a value less than I^2t of a half cycle wave of the symmetrical prospective current. The CLCB limiter shall limit the asymmetrical short circuit fault current below the equipment symmetrical short circuit fault current.
   d. On fault currents below the threshold of current limitation, the normal non-limiter breaker section shall provide conventional time/current overload and short circuit fault protection.

2. Protection Performance Requirements for circuit breakers conforming to the following applications:

- Trip ratings over 600 amp through 5000 amp or less. Identified as current limiting (CLCB) in the Contract Documents.

a. Integrally fused circuit breaker integrated with solid state static digital electronic automatic trip. Combined standard circuit breaker providing overload-short circuit protection within its interrupting capacity and ON-OFF switching function and on each phase current limiters internally mounted on the load side of the circuit breaker, of such ratings that their time current limiting characteristics will coordinate with the time current tripping characteristics of the circuit breaker elements.
b. The coordination shall result in the interruption by the circuit breaker alone of fault level currents up to the interrupting capacity of the circuit breaker and interruption by the current limiter in conjunction with the circuit breaker of fault level currents above the interrupting capacity of the circuit breaker.
c. A removable cover shall be provided over the current limiter section of the integrally fused circuit breaker. The current limiter housing covers shall be interlocked with the breaker tripping mechanism to insure the breaker will trip upon removal of the cover. The cover shall be interlocked with the breaker to insure the circuit breaker cannot be turned to the ON position with the cover removed. Current limiters shall have a spring loaded plunger which, when the limiter blows, is released to actuate the circuit breaker common trip bar mechanism opening all breaker poles simultaneously.
d. The limiters shall be individually interlocked with the breaker element tripping mechanism to insure the limiter cannot be inserted until the breaker is in the OFF position. The circuit breaker and limiters shall be interlocked to insure the circuit breaker cannot be closed if a limiter is either missing or has blown.
e. Fuse limiters shall be individually removable from the circuit breaker housing.
f. The circuit breaker shall be ambient temperature compensating. The circuit breaker shall be provided with thermal magnetic or solid state static digital trip (depending on the coordination study).
g. The integrally fused circuit breaker shall be capable of interrupting available short circuit currents up to 200,000 RMS symmetrical amperes at voltage up to 600 VAC.
h. Ratings, clearances and performance of the integrally fused circuit breaker shall be in accordance with applicable Standards of NEMA, IEEE and UL.

2.3 SWITCH AND FUSE FEEDER PROTECTIVE DEVICES

A. Fusible Switches: Quick-make, quick-break type with rejection clips for use with Class "R" fuses Current Limiting Fuses (CLF). Switches with ratings up to and including 100-amp at 240-volts shall be twins mounted. Switches rated through 60-amp and 480 volts shall be twins mounted. Shall be UL listed suitable for normal and reverse feed. Switches shall be removable from front of switchboard without disturbing adjacent units or switchboard bus structure.

B. Fuses shall be time delay current limiting types, UL Class RK-1 unless otherwise indicated on the Drawings. Provide one spare set of fuses of each size and type in each switchboard.

C. Provide auxiliary contact on switch for remote status (on-off) signaling and monitoring. Provide conductor lugs to accept conductor temperature rating, sizes, and quantities shown on Drawings.

2.4 GROUND FAULT PROTECTIVE SYSTEM AS FOLLOWS:

A. One control power transformer rated 480/120 volts of suitable capacity for shunt tripping of the main circuit breaker and subfeed circuit breakers as indicated on the Drawings. Fuse transformer on the 480-volt side.

B. Ground sensor current transformer for each indicated ground fault relay, zero sequence type with integral test winding for each circuit indicated on Drawings (the 3-phases and neutral conductor shall be brought through the current transformer window per Manufacturer's recommendations). Shall be UL-listed suitable for normal and reverse feed.

C. One ground break, solid-state relay, and monitor and test panel for each device indicated on the Drawings. Pick-up adjustment shall be continuous 100 amp through 1200 amp; time adjustment shall be continuous from instantaneous through sixty cycles. Monitor panel shall indicate relay operation and provide means for system testing with or without interruption of service, and shall not permit system to be inadvertently left in an inactive or off state. Provide resettable trip indicators.

1. Ground fault system shall provide selective trip coordination with other upstream/down-stream ground fault and phase over current circuit protection devices as determined by the coordination study.

    a. Ground fault protection devices shall incorporate adjustable time/current trip settings.
    b. Ground fault protection devices shall incorporate adjustable inverse time and very inverse time adjustable/selective settings.

D. The ground fault system may be integrated into each circuit breaker with solid state trip units, in lieu of the separate specified ground fault relay and monitor panel system. The solid state circuit breaker ground fault system shall provide the identical specified operational features of the described separate system.

E. Each circuit breaker 100 amp and larger, located in the main switchboard(s) and distribution switchboard or main switchgear where the main bus is larger than 800 amp and operating above 240 volt phase-to-phase, shall be provided with ground fault system whether or not shown on the Drawings. Provide all inter-connecting control power and interlocking wire in switchboards/switchgear and between switchboards/ switchgear for an operational system.

2.5 MAIN SWITCHBOARDS

A. Switchboard shall be floor-mounted, dead-front, dead-rear type, front and rear aligned, self-supporting, consisting of one or more vertical sections with bussing, circuit protective devices, instrumentation, auxiliary devices and control wiring as indicated on the Drawings and as specified herein.

1. Shall be utility and service entrance rated and approved.
2. Switchboards shall employ mounting configuration for circuit protective devices as follows:

    a. Group-mount, fixed position, non-drawout switchboards. Front access only, shall not require rear access. Typical for all circuit protective devices or as indicated on Drawings.

3. Switchboards shall employ circuit breakers types and circuit protection devices as follows:

    a. All Main circuit breaker of all frame sizes – ICCB type circuit breakers.
    b. 800 amp and larger frame size Feeder circuit breakers, ICCB type circuit breaker.
    c. Smaller than 800 amp frame size Feeder circuit breakers, ICCB type; or MCCB type circuit breakers.
    d. CLCB type circuit breakers. CLCB circuit type only where noted on the Drawings.

e. CLF with switch and fuse type. CLF with switch and fuse type only where noted on the Drawings.

4. Surge Protection Device – SPD

a. Provide a 3-phase, 5-wire SPD in the switchboard, with 30-amp 3-pole subfeed circuit breaker.
b. See Specifications Section 26 0500 for SPD Additional Requirements.

B. Switchboard shall be designed, built and tested in accordance with applicable portion of the latest editions of NEMA PB-2, Underwriters Laboratories No. UL-891 and the National Electrical Code. Rated for service-entrance operation.

C. Switchboard Sections Configuration

1. Floor standing self-supporting, of the universal frame type using die formed, 12-gauge steel members bolted and welded together.
2. Provide removable side and rear plates with formed edges all around.
3. Provide ventilation openings required for maintaining nominal operating temperature.
4. Provide removable steel cover plates for all usable device spaces. Provide lifting means and provisions for moving by means of rollers or skids to installation location.
5. Bolt individual sections together to form a single rigid switchboard assembly.
6. Provide full height, hinged, vertical wireway metal covers, on each vertical wireway, of each distribution section of the switchboard.
7. Typical for all switchboards, distribution switchboards and switchgear.

D. Switchboard shall include, but not be limited to, the following:

1. Underground pull section as required by the serving utility incoming service.
2. Metering facilities as required by the serving utility.
3. Current transformer space.
4. Main disconnects devices.
5. Distribution and feeder circuit protective devices.
6. District metering (where indicated on Drawings).
7. Bussing, incoming utility compliant and outgoing distribution.
8. Surge Protection Device (SPD).

2.6 DISTRIBUTION SWITCHBOARDS

A. Switchboards shall be floor mounted, dead-front, dead-rear type, front and rear aligned, self-supporting, consisting of one or more vertical sections with bussing, group mounted circuit protective devices, instrumentation and control wiring as indicated on the Drawings and as specified herein. Switchboards shall comply with UL Standard #UL-891 and NEMA-PB2.

1. Distribution switchboards shall be service entrance rated and approved, when located in a building separate and remote from the main service entrance switchboard.
2. Distribution Switchboards shall employ circuit breaker types and circuit protection devices as follows:

a. All Main circuit breakers of all frame sizes - ICCB type circuit breakers.
b. 800 amp and larger frame size Feeder circuit breakers, - ICCB; or MCCB type circuit breakers.
c. Smaller than 800 amp frame sizes Feeder circuit breakers - ICCB; or MCCB type circuit breakers.
d. CLCB type circuit breakers, only where noted on the Drawings.

e. CLF with switch and fuse type. CLF with switch and fuse type only where noted on the Drawings.

B. Distribution Switchboards shall include but not be limited to the following:

1. Main disconnect device (where indicated on Drawings).
2. Feeder protective devices.
3. District metering (where indicated on Drawings).
4. Bussing.
5. Surge Protection Device (SPD).

C. Switchboard Sections

1. Floor standing, self-supporting, of the universal frame type using die formed, 12 gauge steel members bolted and welded together.
2. Provide removable side and rear plates with formed edges all around.
3. Provide ventilation openings required for maintaining nominal operating temperature.
4. Provide removable steel cover plates for all usable device spaces. Provide lifting means and provisions for moving by means of rollers or skids to installation location.
5. Bolt individual sections together to form a single rigid switchboard assembly.
6. Provide full height, hinged, vertical wireway metal covers, on each vertical wireway, of each distribution section of the switchboard.

2.7 MISCELLANEOUS INSTRUMENTS

A. Instrument and Control Transformers: ANSI C57.13 and NEMA ST20 as applicable. Transformers shall be specifically designed for use on respective protective relay or metering schemes utilized.

B. Current transformers meter/relay grade shall be multi-ratio tap, tap setting as indicated on Drawings, (minimum of three field adjustable tap settings) with 5 amp secondary, insulation class, 600 volt, 60Hz, single ring type, and shall have an accuracy classification of 0.3 with the burden of B.01, B.02 and B.03.

C. Control and transfer switches shall be of the rotary, oil-tight multi-position, cam-operated, multi-stage type, with dust cover and silver-to-silver contacts rated 600 volts, 20-amp and adequate for the duty performed in excess of 10-amp. Equip each switch with engraved plastic escutcheon nameplate identifying its function and position.

2.8 CONTROL WIRING

A. Terminal blocks with barriered terminals for each connection shall be provided for all control wiring terminator points. Control wiring shall be run in horizontal and vertical, isolated, internal metal wireways and shall be carried across hinges in laced bundles. Wire terminators shall be crimp-on type spade terminal

B. Secondary control wiring shall be a minimum of 14AWG stranded copper type SIS 600-volt insulation.

C. Control circuits shall have circuit number tags at each termination or break in the wire to match circuit numbers on terminal strips and control wiring diagrams.

2.9 WEATHERPROOF EQUIPMENT

A. Equipment indicated as weatherproof (W.P.) or outdoors should be NEMA 3R, non-walk-in, tamper resistant construction. Provide full height hinged doors with provisions for padlocking the doors in the closed position.

B. Provide a nominal 300-watt sealed, resistance type, anti-condensation heater in each equipment section. Heaters shall be controlled automatically by Thermostats and Humidistats. A circuit breaker shall be provided to supply switchboard buss voltage to the heaters, all prewired by the Manufacturer to fused terminals.

C. Finish shall be electrostatically applied finish paint over iron oxide rust inhibitor primer. Finish color shall be Manufacturer's standard color, olive green Munsel #7GY3.29/1.5. The bottom side and bottom 6-inches of the equipment shall be coated with 4-mil minimum thickness rust inhibitor undercoating over finish paint, on all interior surfaces. Finish withstand test without face corrosion or blistering:

1. Salt spray withstands - 2000 hours ASTM B117.
2. Humidity withstands - 750 hour ASTM D2247.

D. Exposed Hardware and Hinges Shall be Stainless Steel Type 302 or 304, Tamper Resistant

PART 3 - EXECUTION

3.1 GENERAL

A. Install Equipment in accordance with Manufacturer's written instructions and applicable portions of NECA's "Standards of Installations" for switchboards, switchgear and motor control centers.

B. Prior to Energizing and Testing, Manufacturer's field engineer shall visually inspect and verify devices are operational and bus connects complete.

3.2 ANCHORING

A. Bolt Equipment to floor and wall where wall exists. Where units are free standing, provide preformed steel channel or angle iron bracing to nearest wall or building structural member.

B. Equipment anchoring shall be designed for compliance with the earthquake seismic vertical and lateral acceleration of the equipment install location. Submit structural calculations and details.

3.3 FIELD TESTING INSPECTIONS AND COMMISSIONING (ADDITIONAL REQUIREMENTS)

A. Test all Equipment after the installation has been completed, and the District's Representative has been given 10-days' notice of the proposed tests. The Contractor shall provide operating tests demonstrating that all equipment and devices operate in accordance with the Requirements of the documents.

B. Adjustable Settings

1. Shall be set and tested after the equipment installation is complete, for proper operation at set points, pickup, and/or drop-out points. Shall be performed by an independent Test Laboratory and trained certified Technicians actively engaged in testing and using test instruments designed and manufactured for the purpose.

2. Provide protection device settings and test, to insure operation and coordination as described in the time/current coordination final submittal, and in accordance with the Contract Documents.
3. Calibrate and testing shall comply with the Equipment Manufacturer recommendations.
4. Correct deficiencies, non-compliant equipment and retest to demonstrate compliance.
5. Submit reports to District's Representative, six copies.

C. Testing shall be completed in accordance with ANSI/NETA Standards.

3.4 IDENTIFICATION (ADDITIONAL REQUIREMENTS)

A. Provide a red and white Bakelite nameplate with ½-inch high letters in each Section fastened to face of dead-front plate, to read: "DANGER 480 (actual volts) VOLTS, KEEP OUT, AUTHORIZED PERSONNEL ONLY".

B. Manufacturer shall stencil the equipment name on each Device and Equipment Section to correspond to the identification of the Drawing.

C. Devices mounted in equipment controlling protective devices shall be provided with nameplates indicating device controlled or monitored.

END OF SECTION 262413
040119/212227

SECTION 262416 - BRANCH CIRCUIT PANELBOARDS AND TERMINAL CABINETS

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other Specification Sections and Drawings for related work required to be included as work under Division 26.
2. General Provisions and Requirements for electrical work.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Provide Manufacturers Catalog Data for Panels, Cabinets, and Circuit Breakers.

B. Provide Shop Drawing showing Panel Circuit arrangements, size, voltage, ampacity, overcurrent protective devices, etc.

C. Provide nameplate engraving schedule.

D. Short Circuit, Coordination and Arc-Flash

1. Perform and submit engineered settings for each equipment location, fuse and adjustable circuit breaker device, showing the correct time and settings to provide the selective coordination within the limits of the specified equipment, per the latest applicable standards of IEEE and ANSI. Provide electrical system short circuit fault analysis, both 3-phase line-to-line and 1-phase line-to-ground calculations as part of the Coordination Analysis recommendations. Provide Electric Arc-Flash Calculations as part of the Coordination Analysis recommendations.
2. The information shall be submitted in both tabular form and on time current log-log graph paper, with an Engineering Narrative. Written narrative describing data, assumptions, analysis of results and prioritized recommendations, six copies.
3. The goal is to minimize an unexpected but necessary electrical system outage and personnel exposure to the smallest extent possible within the fault occurrence location, using the specified Contract Equipment. Shall comply with, but not limited to:

    a. IEEE-242, Recommended Practices for Protection and Coordination of Industrial and Commercial Distribution.
    b. IEEE-399, Recommended Practice for Industrial and Commercial Power System Analysis.
    c. IEEE-1584, Guide to Performing Arc-Flash Hazard Study.
    d. CEC/NEC

4. Electrical equipment including switchgear, switchboards, electrical panels, and control panels, transformers, disconnects, etc., shall each be labeled by the Manufacturer with “Electrical-Arc-Flash” warning signs. The signs shall explain a hazard to Personnel may exist if the equipment is worked on while energized or operated by personnel, to wear the correct Protective Equipment/clothing (PPE) when working “Live”, or operating “Live” equipment and circuits.

5. The Contractor shall independently contact the serving Utility Company to obtain the current system short circuit amps or available fault current.
6. The Contractor shall independently obtain As-Built Drawings for the existing infrastructure to establish lengths. If As-Built Drawings are no available, the Contractor shall research existing conditions and make reasonable but conservative estimates of conductor length. Where existing conductors have been re-used, the Contractor shall confirm conductor quantity, size, and conduit type.

1.3 SEISMIC EARTHQUAKE AND WIND LOADING WITHSTAND, TESTING AND CERTIFICATION. (ADDITIONAL REQUIREMENTS)

A. General

1. The complete panels and terminal cabinet assemblies; including circuit protection devices, meter, housings/enclosures, accessories, supports/anchors etc., shall be designed, manufactured and tested.

    a. Wind loading all outdoor equipment locations.
    b. Earthquake CBC/IBC Seismic withstand all indoor and all outdoor equipment locations.

2. Shall withstand, survive and maintain continuous non-interrupted energized operation during the seismic event occurrences and wind event occurrences. Continued normal energized operation after the wind event and seismic event occurrences have abated.
3. Shall include demonstrations of successful operation and run test after completion of seismic event shake-table simulation. Acceptance test seismic qualification shall employ triple axis shake-table simulation of the Required Response Spectrum (RRS) seismic event motion, certified and approved by the AHJ.
4. Provide three dimensional finite element analysis demonstrating anchorage and operational withstand of wind loading not less than as follows and as required by AHJ:

    a. 110MPH – West Coast USA and Hawaii, per ASCE/SEI 7-10.

5. Seismic Test shall be performed by a third party independent Test Laboratory. Wind Analysis and Seismic Testing and Reports shall be certified, signed and “stamped” by PE Professional Engineer licensed and in good standing in the State, Civil Engineer or Structural Engineer.

B. Refer to General Commissioning Section 019113 for Additional Requirements.

PART 2 - PRODUCTS

2.1 PANELBOARDS AND DISTRIBUTION PANELS

A. Shall be flush or surface mounting as indicated with group -mount circuit protection devices as shown on panel schedule, hinged lockable doors, index cardholders and proper bussing.

1. Panelboards shall comply with the latest versions:

    a. NEMA – PB1.
    b. UL – 50 and 67.
    c. CEC/NEC.
    d. ASTM-B187.

2. Where indicated on the Drawings shall be furnished with subfeed breakers and/or additional conductor lugs, split bussing, contactors, time switches, relays, etc., as required.

    a. Branch circuit panels up through 42-circuits shall be single section, to accommodate all of the circuits and components.
    b. Distribution panels shall be single section or multi-section, to accommodate all of the circuits and components.

3. Panels shall be “Service-Entrance” equipment rated when the panel main incoming supply feeder originates from one of the following:

    a. Originates outdoors exterior of the building in which the respective panel is located.
    b. Originates from an electrical supply source not located in the same building as the respective panel.

B. Housing and Painting, Panels and Terminal Cabinets

1. Shall be finished with one coat of rust inhibitor zinc chromate and coat of primer sealer after a thorough cleaning.
2. Finish color paint as selected by District’s Representative where exposed to public view (e.g., corridors, covered passages, offices, etc.). Prime coated panelboard shall be painted to match surroundings after installation in public areas.
3. Manufacturer’s standard color in electrical rooms/closets, janitors, HVAC and storage rooms.
4. Shall be fabricated of sheet steel of the following minimum gauges.

    a. Full height hinged, locking door. Trim #12 gauge steel; enclosure - Code gauge steel.
    b. Panels installed in indoor dedicated electrical equipment rooms and dedicated electrical equipment closets, omit full height hinged locking panel door. Dead front cover behind omitted panel door shall remain.

5. NEMA-1 Metal Housing, for indoor locations.
6. NEMA-3R Metal Housing, tamper resistant, for outdoor locations.
7. Furnish all panels and terminal cabinets with the Manufacturers flush locks and keys except where indicated otherwise herein. Keys and locks shall be interchangeable for all panels. Provide two latches and two locks for door heights exceeding 36-inches.
8. Fasten the trim to panel and terminal cabinets by means of concealed, bolted or screwed fasteners accessible only when the door is open.

C. Panels 208/120 volt, three phase, 4-wire, S/N or 120/240 volt, single phase, 3-wire, S/N.

Branch Circuit Panel as manufactured by:

1.	Cutler Hammer	“Pow-R-Line 1 or 2” Series
2.	General Electric	"A" Series
3.	Square D	“NF/NQ” Series
4.	Siemens	“P1/P2” Series

D. Distribution Panels as manufactured by:

1.	Cutler Hammer	“Power-R-Line 3 or 4” Series
2.	General Electric	“Spectra” Series
3.	Square D	“I-Line” Series
4.	Siemens	“P4/P5” Series

E. Top and bottom gutter space shall not be less than 6-inches high. Provide 6-inches additional gutter space in all panels where double lugs are required, or where cable ampere size exceeds bus ampere size. Provide 12-inches additional gutter space in all panels for aluminum feeders where used.

F. Panel Dimensions.

1. Panels with buss sizes 50 amp thru 400-amp.

   a. Shall be 20-inches wide. Surface or flush mounting as indicated.
   b. Recess mounted type shall have a 20-inches wide (maximum) recess metal enclosure with overlapping edge trim plate cover extending 1-inch on all sides of enclosure.
   c. Depth shall be 5.75-inches nominal. Height of panel as required for devices.

2. Panels with buss sizes greater than 400-amp.

   a. Narrow panels 24-inches (maximum) wide by 6.5-inches (maximum) deep units. Wide panels' 25-inches to 44-inches (maximum) wide by 8-inches to 15-inches (maximum) deep units. Nominal 90-inch panel height.
   b. The wider units shall be used only at locations where the narrow unit is not available with the quantity or size of large-ampere frame branch/subfeed circuit protective devices shown on the panel schedules, or where the main breaker size exceeds the narrow panel maximum.
   c. Distribution panels shall be floor standing and also supported from behind the panels at walls.

G. Distribution panels and branch circuit panels maximum load rating

1. Panelboards and Distribution Panels exceeding 800-amp load rating shall not be permitted.
2. Provide Distribution Switchboards instead of Distribution Panels for bus load and circuit load ratings exceeding 800-amp.

H. Panel Auxiliary Cabinets

1. Panelboards shown on the Drawings with relays, time clocks or other control devices shall have a separate auxiliary metal barrier compartment mounted above panel.
2. Panelboards with circuits controlled by low voltage remote control relays shall be provided with separate auxiliary cabinets to contain the relays, adjacent to the panelboard.
3. Provide auxiliary cabinets with separate hinged locking door to match panelboard.
4. Provide mounting subbase in cabinet for control devices and wiring terminal strips.

I. Panels shall have a circuit index cardholder removable type, with clear plastic cover. Index card shall have circuit numbers imprinted to match circuit breaker numbers.

1. The panel identification nameplate shall describe the respective panel name and voltage, corresponding to the Contract Documents.
2. The electrical power source, name and location of each panel supply-feeder and supply equipment name shall also be identified and described on the respective panel nameplate.

J. SPD - Surge Protection Device

1. Provide each of the following branch circuit panel and distribution panel types with a SPD and RF filtering:

    a. 208/120 volt - single phase and/or three phase.
    b. 120/240 volt - single phase.
    c. 480/277 volt - single phase and/or three phase.
    d. All distribution panels.

2. The SPD shall be installed inside the respective panel housing and shall be factory connected to each main phase, ground and neutral bus inside the panel.
3. The SPD monitor/annunciator indicators shall be visible only when the panel access door is in the open position.
4. Provide a 20-amp 3-pole (2-pole for single-phase panels) branch circuit protection device in each panel for SPD connection.
5. The SPD device and panel shall be UL labeled and listed for combined use. See related Specification Sections for Additional SPD Requirements.

K. Seismic Earthquake and Wind Loading Withstand, Testing and Certification (Additional Requirements)

1. The complete panel/panelboard assembly; including circuit protection devices, housings /enclosures, accessories, supports/anchors etc., shall be designed, manufactured and tested for Wind Loading and Earthquake Seismic withstand.
2. Shall withstand, survive and maintain continuous non-interrupted energized operation (running) during the seismic event occurrences. Continued normal energized operation after the wind event and seismic event occurrences have abated.
3. Shall include demonstrations of successful operation and run test after completion of seismic event shake-table simulation.
4. Provide three dimensional finite element analysis demonstrating anchorage and operational withstand of wind loading as follows:

    a. 100MPH – West Coast States USA and Hawaii, per ASCE/SEI 7-10.

5. Acceptance test seismic qualification of proposed panels and panelboards shall employ triple axis shake-table simulation of the Required Response Spectrum (RRS) seismic event motion, certified and approved by the AHJ.
6. Seismic test shall be performed by a third party independent test laboratory. Wind Analysis and Seismic Testing and reports shall be certified, signed and “stamped” by PE Professional Engineer licensed and in good standing in the State, Civil Engineer or Structural Engineer.

2.2 SHORT CIRCUIT RATING

A. Circuit protective devices and bussing as indicated on the Drawings. All devices and bussing shall have a short circuit fault withstand and interrupting capacity not less than the maximum available fault current at the panel and as indicated on the Drawings, plus a 25% additional capacity (safety margin).

However, in no case shall the short circuit fault interrupting and withstand capacity be less than the following symmetrical short circuit.

	C/B and/or Bus Rating	Circuit Voltage	Short Circuit Amp.
1.	400A and less	240V and below	10,000A
2.	400A and less	over 240V and below 600V	14,000A
3.	Over 400A, 800A and below	240V and below	42,000A
4.	Over 400A, 800A and below	over 240V and below 600V	30,000A

B. Panel Short Circuit Fault Rating

1. General

a. Provide a "fully rated" for short circuit fault interrupt and full load ampere main circuit breaker in each branch circuit panel and/or each distribution panel. Provide the main circuit breaker whether or not a main circuit breaker is shown otherwise on the Drawings, Schedules or Diagrams. The "utility-source" plus the "motor-load" transient contributions shall be used to establish the available fault duty values, unless indicated otherwise on the Drawings.
b. The panel main circuit breaker full load ampere capacity rating shall equal the respective panel main bus ampere rating.
c. The panel assembly, buss and circuit protection devices bolted fault short circuit withstand and bolted fault short circuit interrupt ratings shall not be less than 125% greater (including a 25% safety margin) than the available utility-source symmetrical and asymmetrical bolted fault short circuit current when "Series Combined Rated" with the panel main circuit breaker.
d. The main circuit breaker rated "bolted-fault" short circuit fault interrupt and withstand short circuit rating shall not be less than 125% (including a 25% safety margin) of the upstream main service entrance "bolted-fault" available (symmetrical and asymmetrical) short circuit current.

2. Distribution Panelboards

a. Distribution panel, main circuit breaker, all feeder circuit breakers, and all branch circuit breakers shall be "fully-rated" (plus safety margin) for the available bolted fault short circuit current (including safety margin).
b. Shall provide time/current-tripping coordination with downstream equipment and upstream equipment.

3. Non-emergency branch circuit panelboards 400-amp buss and smaller; Non-emergency branch circuit panelboards 400-amp trip main circuit breaker and smaller.

a. The branch circuit panel main circuit breaker shall be "fully-rated" (plus safety margin) Current Limiting Circuit Breaker type (CLCB). Shall provide time/current- tripping coordination with upstream equipment.

b. The branch circuit panel main circuit breaker shall be "series-rated" with the panel downstream branch circuit devices and panel bussing. "The series-rating" shall provide short circuit bolted fault current withstand protection and short circuit bolted fault interrupt rating protection during a downstream 3-phase line-to-line and/or single-phase line-to-ground short circuit bolted faults.
c. Typical for branch circuit panelboards connected to normal-power (non-emergency) power circuits.

4. Emergency branch circuit panelboards 400-amp bus and smaller; Emergency branch circuit panel-boards 400-amp trip main circuit breaker and smaller.

a. The branch circuit panel main circuit breaker shall be short circuit bolted fault "fully-rated" (plus safety margin) Non-Current Limiting circuit breaker type (non-CLCB).
b. The panel bussing shall also be short circuit bolted fault "fully-rated".
c. All of the branch circuit panel, branch circuit breakers shall be "fully-rated" non-fused Current Limiting Circuit Breaker Type (CLCB). Shall provide short circuit bolted fault interrupt rating. Coordinated time/current and instantaneous tripping with the upstream circuit protection devices.
d. Typical for branch circuit panelboards connected to emergency power circuits.

2.3 PANEL CIRCUIT BREAKERS, CIRCUIT PROTECTION DEVICES

A. Circuit Breakers General, for Distribution Panels and Panelboards

1. NEMA-AB1 and AB3, comply with latest revision.
2. UL-1087, UL-489 and IEC-60.947.2 rated devices, comply with latest revision.
3. 5Hz AC closing and 3Hz AC trip and clear.
4. Main circuit breakers for distribution panels exceeding 400-amp and larger;

    a. Shall be Insulated Case Circuit Breaker type ICCB.

5. Main circuit breakers for branch circuit panelboards 400 amp buss and smaller;

    a. Shall be Current Limiting Circuit Breaker type-CLCB for non-emergency panelboards.
    b. Shall be Molded Case Circuit Breaker type-MCCB for emergency panelboards.

6. Branch circuit breakers and feeder circuit breakers smaller than 100-amp trip shall be Molded Case Circuit Breakers type-MCCB and/or Current Limiting Circuit Breakers type-CLCB.
7. All circuit breakers 100-amp and larger trip shall employ sensors and solid state digital electronic automatic trip system. Short-time and long-time time/current curve shaping field adjustable functions and adjustable instantaneous trip. Typical for Molded Case Circuit Breaker type-MCCB, Insulated Case Circuit Breaker type-ICCB and Current Limiting Circuit Breaker type-CLCB.
8. Refer to Specification Section 262413 and/or 261100 for additional Circuit Breaker Requirements.

B. Manufacturer

1. Circuit breakers as manufactured by the following companies only are acceptable:

    a. Cutler Hammer
    b. General Electric Co.
    c. Square D Co.
    d. Siemens

C. Configuration

1. Circuit breakers shall be arranged in the panels so that the breakers of the proper trip settings and numbers correspond to the numbering in the panel schedules on the Drawings.
2. Circuit numbers of breakers shall be black-on-white micarta tabs or other previously approved method. Circuit number tabs, which can readily be changed from front of panel, will not be accepted. Circuit number tabs shall not be attached to or be a part of the breaker.
3. Panelboard circuit protection devices shall be bolt on type for connection to panel bus. Removable and installable without disturbing adjacent devices.

4. Provide conductor wire terminations (lugs) on each circuit protection device for incoming main feeder, branch circuits and outgoing feeder circuits. Dual rated copper/aluminum and compatible with the respective conductor size, type, and quantity.
5. Where 2-pole or 3-pole breakers occur in the panels, they shall be common trip units. Single pole breakers with tie-bar between handles will not be accepted.
6. Branch circuit panels shall be field convertible for bottom entry main incoming feeder or top entry main incoming feeder.
7. Each panel section, the feeder and branch circuit protection devices (3-phase and/or 1-phase) shall be "twin-mount", side-by-side double row construction for the following circuit sizes:

    a. 480/277 volt, 60-amp circuit size and smaller.
    b. 240 volt – 208/120 volt, 100 amp circuit size and smaller.

D. Lock-Off and Lock-On

1. All circuit breakers shall be pad-lockable in the "off" position.
2. Where branch circuit breakers supply the power to motors and signal systems, the breakers shall also be furnished with lockout clips, mounted in the "on" position. The breakers shall be able to trip automatically with lockout clips in place.
3. Provide lock-on clips on branch circuit breakers supplying fire alarm equipment and fire alarm panels. Provide identification of the dedicated "fire alarm" circuit function and operation. Color-code the circuit breakers to comply with AHJ Requirements.
4. Locking facilities shall be riveted or mechanically attached to the circuit breaker (submit sample for approval. Other means of attachment shall not be accepted without prior written approval of the District's Representative.

E. Arc Fault Interrupter Circuit Breaker (AFCI-C/B)

1. AFCI-C/B provides automatic circuit interruption upon detection of any of these conditions: overload, short circuit fault and electric branch circuit arcing protection.
2. The AFCI-C/B shall detect intermittent "arcing" type electrical faults, and provide automatic circuit interruption (tripping).
3. Provide "test-pushbutton" on each C/B for manual AFCI-C/B Testing.
4. Single pole, 120-volt, 60Hz AC UL listed and labeled for installation in panelboard, #14 - #8AWG solid/stranded AL/CU load conductor.

F. Switch and Fuse Feeder Protective Devices for Distribution Panels

1. Locations where the Drawings show distribution panels employing switch-fuse circuit protection devices.
2. Fusible Switches: Quick-make, quick-break type with rejection clips for use with Class "R" fuses Current Limiting Fuses (CLF). Switches with ratings up to and including 100-amp at 240 volts shall be twins mounted. Switches rated through 60 amp and 480 volts shall be twins mounted. Provisions for padlocking in the "on" and/or "off" positions. Switches shall be removable from front of panel without disturbing adjacent units or panel bus structure.
3. Fuses shall be time delay current limiting types, UL Class RK-1 unless otherwise indicated on the Drawings. Provide one spare set of fuses of each size and type in each Distribution Panel.
4. Provide auxiliary contact on switch for remote status (on-off) signaling and monitoring. Provide conductor lugs to accept conductor temperature rating, sizes and quantities shown on Drawings.
5. Switch and fuse devices shall be permitted only in distribution panels and only where specifically indicated on the Drawings for feeders.

2.4 PANEL BUSSING

A. Bus Material

1. Bussing shall be rectangular cross section tin-plated copper or alternately silver or tin-plated aluminum.
2. Bussing shall be non-tapped, full length of the enclosure.

B. Ground Bus

Each panel shall be equipped with a ground bus secured to the interior of the enclosure. The bus shall have a separate lug for each ground conductor. No more than one conductor shall be installed per lug.

C. Provisions

Provide space and all hardware and bus mounting attachments for future devices as indicated on the Drawings.

D. Neutral Bus

The ampere rating of the neutral bus of panels and distribution panels shall be a minimum of 100% greater ampere capacity than the ampere rating of the corresponding phase bus, where the panel is indicated to be provided with an “oversize-neutral” or “200%” neutral on the Drawings.

2.5 TERMINAL AND AUXILIARY CABINETS

A. Cabinets

1. Fabricated of Code gauge sheet steel for flush mounting (except where noted as surface) of size indicated on the Drawings, and complete with hinged lockable doors, provide the quantity of 2-way feed through conductor terminals required for termination of all conductors, plus 15% spares of each type.
2. Cabinet locks to operate from same key used for panelboards. The trim to cabinets shall be fastened by means of concealed bolted or screwed fasteners accessible behind door into cabinets. All cabinets shall have ⅝-inch plywood backing, finished with fireproof intumescent primer and finish coat paint. Provide equipment ground bus in each cabinet.
3. Cabinets shall be finished with one coat of zinc chromate and one coat of primer sealer after a thorough cleaning. Where exposed to public view (e.g., corridors, covered passages, offices, etc.) finish color paint to match surrounding and Manufacturer’s standard gray color in switchboard, janitors, heater and storage rooms.
4. Provide grounded metal barriers inside cabinet to isolate and separate line voltage and low voltage from each other inside the cabinet.

B. Cabinet Dimensions.

1. Unless indicated otherwise on Drawings.

    a. Shall be 20-inches wide. Surface or flush mounting as indicated.
    b. Recess mounted type shall have a 20-inches wide (maximum) recess metal enclosure with over-lapping edge trim plate cover extending 1-inch on all sides of enclosure.

2. Depth shall be 5.75-inches nominal. Height of cabinet as required for devices, plus 25% spare unused interior space for future use, but not less than 36-inches high.

C. Terminals

1. Non-digital analog circuits; line and low voltage modular signal systems, 15-amp dual row with isolation barriers, screw-down terminals insulated strips, heavy duty.

a. As manufactured by Molex, or ITT-Cannon, or General Electric.

2. Digital circuits; low voltage signal systems, ANSI/EIA/TIA Category-6, 110-Block or 66-Block gas-tight punch down style, heavy duty.

a. As manufactured by: Leviton, or Ortronics, or AMP.

D. Identification (Additional Requirements)

1. Provide engraved nameplate on each cabinet indicating its designation and system (i.e., “Life Safety System - Panel 2LS”, etc.).
2. Identify each terminal landing with unique circuit number and provide corresponding alphanumeric text-index card inside panel access door

PART 3 - EXECUTION

3.1 MOUNTING

A. Flush Mounted Panelboards and Terminal Cabinets shall be securely fastened to at least two studs or structural members. Trim shall be flush with finished surface.

1. Panels and cabinets installed flush (recess or semi-recess) into fire rated or smoke rated walls. The wall recess shall be fully wrapped inside the recess with fire/smoke rated materials. The wrap-materials shall provide the same fire and/or smoke protection rating as the respective wall.

B. Surface Mounted Panels and Terminal Cabinets shall be secured to walls by means of preformed galvanized steel channels securely fastened to at least two studs or structural members.

C. Panelboards and Terminal Cabinets shall be installed to insure the top circuit protective device (including top compartment control devices) are not more than 6-feet-6-inches above finish floor in front of the panel and the bottom device is a minimum of 12-inches above the floor. Manufacturer shall specifically indicate on Shop Drawing submittals each panel where these conditions cannot be met.

3.2 IDENTIFICATION (ADDITIONAL REQUIREMENTS)

A. Provide a red and white Bakelite nameplate with ½-inch high letters in each 277/480 volt panel fastened to face of dead-front plate, to read: “DANGER 480 (or as applicable) VOLTS KEEP OUT AUTHORIZED PERSONNEL ONLY”.

B. Manufacturer shall stencil the panel/cabinet number identification on the inside of door to correspond with the designation on the Drawings.

C. Identification plates and numbers shall be attached with screws or twist lock fasteners. Adhesive attachment of any kind shall not be used.

3.3 SPARE CONDUITS (ADDITIONAL REQUIREMENTS)

Provide three 1-inch conduit only stubs from each panel and terminal cabinet into accessible ceiling space. Where floor level below panel or terminal cabinet is accessible, also provide an additional three 1-inch conduit only stubs into accessible floor space.

END OF SECTION 262416
040119/212227

[blank page]

SECTION 262419 - MOTOR CONTROL EQUIPMENT

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment necessary for, and incidental to, performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other Specification Sections and Drawings for related work required to be included as work under Division 26.
2. General Provisions and Requirements for electrical work.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Provide Schematic "Ladder-Type" Logic Control Wiring Diagrams and "point-to-point" control wiring diagrams showing the control system for HVAC equipment and other electrical equipment.

B. Provide Nameplate Engraving Schedule.

C. Submit Full-Scale Time/Current Transparencies on log/log paper for all fuses, circuit breakers, ground fault system devices, and relays.

D. Short Circuit, Coordination and Arc-Flash

1. Perform and submit engineered settings for each equipment location, fuse and adjustable circuit breaker device, showing the correct time and current settings to provide the coordination within the limits of the specified equipment, per the latest applicable standards of IEEE and ANSI. Provide electrical system short circuit fault analysis, both 3-phase line-to-line and 1-phase line-to-ground calculations as part of the Coordination Analysis recommendations. Provide Electric Arc-Flash calculations as part of the Coordination Analysis recommendations.
2. The information shall be submitted in both tabular form and on time current log-log graph paper, with an Engineering Narrative. Written narrative describing data, assumptions, analysis of results and prioritized recommendations, six copies.
3. The goal is to minimize an unexpected but necessary electrical system outage and personnel exposure to the smallest extent possible within the fault occurrence location, using the specified Contract Equipment. Shall comply with, but not limited to:

    a. IEEE-242, Recommended Practices for Protection and Coordination of Industrial and Commercial Distribution.
    b. IEEE-399, Recommended Practice for Industrial and Commercial Power System Analysis.
    c. IEEE-1584, Guide to Performing Arc-Flash Hazard Study.
    d. CEC

4. Electrical equipment including switchgear, switchboards, electric panels and control panels, motor control centers, combination motor starters, transformers, disconnects, etc., shall each be labeled by the Manufacturer with “Electrical-Arc-Flash” warning signs. The signs shall explain a hazard to personnel may exist if the equipment is worked on while energized or operated by personnel while energized. The

sign shall instruct personnel to wear the correct Protective Equipment/clothing (PPE) when working "Live", or operating "Live" electrical equipment and circuits.

5. The Contractor shall independently contact the serving Utility Company to obtain the current system short circuit amps or available fault current.
6. The Contractor shall independently obtain As-Built Drawings for the existing infrastructure to establish lengths. If As-Built Drawings are no available, the Contractor shall research existing conditions and make reasonable but conservative estimates of conductor length. Where existing conductors have been re-used, the Contractor shall confirm conductor quantity, size, and conduit type.

PART 2 - PRODUCTS

2.1 GENERAL

A. Division 240000 HVAC/Plumbing

Refer to Division 260000 Mechanical and Plumbing Contract Documents and Shop Drawings for Additional Electrical Work and Material Requirements.

1. Provide all control devices including timeswitches, relays, auxiliary contacts, voltage transformers, and interlocks.
2. Provide all raceways, conduit wire, circuits, outlets, and interconnections of starters as required for HVAC and Plumbing systems.

B. Special Considerations

1. Mount all auxiliary relays and timeswitches in an isolated compartment inside motor control equipment unless otherwise indicated.
2. Whether or not shown on Mechanical and Plumbing Contract Documents and/or control schedules, where motors are controlled by external devices (i.e., thermostats, relays, float or pressure switches, etc.) or interlocked with other motors, provide each magnetic motor starter with a "Hand-Off-Auto" selector switch in starter cover. Other magnetic motor starters provide a "Start-Stop" push-button station in starter cover.
3. Motor starters, motor controllers and circuit feeder tap devices for motor circuits shall be rated and labeled for control of all electric motor design types A, B, C, D, and E pursuant to the Requirements of the NEC

C. Seismic Earthquake and Wind Loading Withstand, Testing and Certification (Additional Requirements)

1. The complete motor control equipment assembly; including circuit protection devices, motor controllers, housings/enclosures, accessories, supports/anchors etc., shall be designed, manufactured and tested.

    a. Wind loading for outdoor locations.
    b. Earthquake Withstand and CBC Seismic Withstand all indoor and all outdoor equipment locations.

2. Shall withstand, survive and maintain continuous non-interrupted energized operation (running) during the seismic event occurrences. Continued normal energized operation after the wind event and seismic event occurrences have abated.
3. Shall include demonstrations of successful operation and run test after completion of seismic event shake-table simulation.

4. Provide three dimensional finite element analysis demonstrating anchorage and operational withstand of wind loading not less than as follows and as required by AHJ:

   a. 110MPH-West Coast States USA and Hawaii, per ASCE/SEI 7-10.

5. Acceptance Test Seismic qualification of proposed motor control equipment shall employ triple axis shake-table simulation of the Required Response Spectrum (RRS) seismic event motion, certified and approved by the AHJ.
6. Seismic test shall be performed by a third party independent Test Laboratory. Wind Analysis and Seismic Testing and Reports shall be certified, signed and "stamped" by PE Professional Engineer licensed and in good standing in the State, Civil Engineer or Structural Engineer.

D. Motor Control Equipment as Manufactured by:

General Electric; or Square D; or Cutler-Hammer; or Allen-Bradley; or Siemens.

2.2 MANUAL MOTOR STARTERS

A. Provide flush or surface mounting manual motor starters with number of poles and size of thermal overload heaters as required for the motor being controlled (equipped with overload heaters, one for each motor lead). Back boxes shall be supplied with all flush mounting starters, whether they are toggle type requiring only a 4-inch square outlet box or the larger type requiring a special box. Provide cover designed to accept the particular unit.

B. Unless otherwise noted on the Drawings, all manual starters for single phase motors, smaller than 1 h.p. shall be the compact toggle type. Manual starters for all single phase motors, 1 to 5 h.p. and all three phase motors up to 5 h.p. shall be the heavy-duty type.

C. Where Manual Motor Starter is shown with pilot light, the pilot light shall be installed in a separate outlet box adjacent to the starter outlet with engraved nameplate to indicate function of pilot light. Pilot lights shall be push-to-test style.

2.3 FEEDER TAP DEVICES

A. General

1. Feeder tap devices shall be coordinated with the motor starter unit's electrical and mechanical characteristics. Operating handle shall be accessible and operable from the unit front with positive visible indication of the on, off and tripped operating handle positions.
2. Feeder tap devices shall have a short circuit and motor locked rotor interrupting capacity, series rated with the respective motor starter of not less than the maximum available fault current at the device as indicated on the Drawings, but in no case shall the interrupting capacity be less than 30,000 amp symmetrical interrupting for 480/277 volt devices and 42,000 amp symmetrical for 240 volt or 208/120 volt devices. Provide four key interlocking and padlock-off devices on each feeder tap unit.
3. Feeder tap device (i.e. circuit breakers, switch and fuse or motor circuit protector) shall be as indicated on the Drawings. Where feeder tap device type is not indicated, provide switch and fuse type device.
4. Circuit breakers shall provide time overcurrent and instantaneous circuit protection. Motor circuit protectors shall provide instantaneous magnetic only circuit protection. Feeder tap devices shall be UL component listed and rated with the respective motor starters.
5. Feeder tap device shall provide an auxiliary contact to automatically connect and disconnect control power when the feeder tap device is open, tripped or closed.

6. Provide an auxiliary contact on feeder tap device for remote status (on-off) signaling and monitoring.
7. Provide conductor lugs to accept conductor temperature rating, sizes, and quantities shown on the Drawings.

B. Feeder Tap Devices shall be as indicated on the Drawings:

1. Circuit breaker feeder tap

a. Circuit breakers shall employ a stored energy, quick make-quick break, and trip free operating system on each phase, with common trip. Breakers shall comply with UL 489 and 1087, NEMA AB1 AB3 latest revisions. Circuit breakers noted as "100%" on the Drawings shall be rated to carry the breaker full rated (100%) ampere load continuously.

b. Protection Performance Requirements for circuit breakers conforming to one or more of the following applications:

- 600-amp or larger frame size.
- Larger than 400-amp trip.
- Service entrance motor control center.
- Noted as main circuit breakers on the Drawings.

1) Circuit breaker shall employ current sensors and solid state static digital electronic automatic trip system. Three-phase or single-phase operation as noted on the Drawings. Current carrying components shall be completely isolated from the static trip units. The trip unit shall be independent of external power sources. Circuit breaker shall be UL listed for reverse connection.

2) Circuit breaker solid state trip control functions shall provide the following time /current curve shaping field adjustable features;

a) Adjustable ampere setting to vary the long-time continuous current carrying capacity, minimum range of 80% through 100% of full load trip rating.

b) Adjustable long-time delay setting to vary the time the breaker will trip under sustained overload conditions. Minimum of three settings, "minimum-intermediate-maximum".

c) Adjustable short-time pickup to vary the level of high current the breaker can carry for short periods of time, minimum range of 2 times through 8 times of ampere setting.

d) Adjustable short time delay to vary the time of the short-time pickup. Minimum of three settings "minimum-intermediate-maximum".

e) Short time "I^2t" switch to allow a current-squared multiplied by time ramp function in the short-time system. Two position setting "in-out".

f) Adjustable instantaneous pickup to vary the breaker ampere setting for immediate (instantaneous) interruption of severe overloads (short circuits). Adjustable minimum range of 2.0 times through 13 times of circuit breaker ampere sensor rating. Circuit breaker shall incorporate adjustable instantaneous trip settings to allow coordinated instantaneous trip settings when protecting energy efficient motors.

g) Individual fault trip indicators shall provide local indication on the breaker for overload and short circuit (and ground fault where applicable) conditions.

h) Provide one Manufacturer standard test set for solid state trip circuit breakers.

c. Protection Performance Requirements for circuit breakers conforming to one or more of the following applications:

- Smaller than 600 amp frame size.
- 400 amp and smaller trip.
- Larger than 100 amp frame size.
- Larger than 100 amp trip.

1) Circuit breaker shall employ current sensors and solid-state static digital electronic automatic trip system. Time/current curve shaping field adjustable features.
2) Solid state trip breakers shall conform to the Requirements described above for solid state breakers larger than 400 amp trip. However, only the following field adjustments are required;

a) Ampere setting adjustable minimum range of 80% through 100% of full load trip rating.
b) Short time pickup adjustable minimum range of 2 times through 8 times of the ampere setting.
c) Adjustable instantaneous trip (circuit breaker shall incorporate adjustable instantaneous trip settings to allow coordinated instantaneous trip settings when protecting energy efficient motors).

d. Performance Requirements for circuit breakers conforming to the following applications:

- 100-amp frame size and smaller.
- 100-amp and smaller trip.

1) Circuit breaker shall be fixed or adjustable instantaneous trip with thermal-magnetic trip or with solid-state static digital electronic automatic time/over current automatic trip depending on the results of the Coordination Study.

e. Current Limiting Circuit Breakers (CLCB):

1) Performance Requirements for circuit breakers conforming to the following applications:

- 600 amp and smaller trip and identified as Current Limiting (CLCB) on the Drawings.

a) Current Limiting Circuit Breakers shall be supplied in unit molded case construction and shall consist of a common trip, thermal-magnetic or solid state trip circuit breaker with an independently operating limiter section in series with each pole.
b) The conventional breaker section shall have an over center, trip-free, toggle-type mechanism with quick-make, quick-break action and positive handle indication. A button shall be provided on the cover for mechanically tripping the circuit breaker. The current limiting breaker shall have permanent trip units containing solid state static digital trip or individual thermal and magnetic trip elements in each pole. Calibrated for 40 degrees C ambient temperature. The limiter section shall consist of three current limiting elements electrically coordinated with the conventional circuit breaker trip elements. The contacts of the limiter section shall be electro-magnetically and electro-dynamically opened and held open until interruption is complete.

c) Current and Energy Limitations: On high-level fault currents the limiter portion of the circuit breaker shall operate to limit the rise of fault current. Integral resistance shall be introduced into the faulted circuit to dissipate and limit let-through energy and to provide a voltage transient-free interruption at near unity power factor. The Let-through short circuit fault current and energy levels shall be less than that permitted by Underwriters Laboratories to a Value less than I^2t of a half cycle wave of the symmetrical prospective current. The CLCB limiter shall limit the Asymmetrical short circuit fault current below the equipment symmetrical short circuit fault current.

d) On fault currents below the threshold of current limitation, the thermal-magnetic breaker section shall provide conventional overload and short circuit protection.

2) Performance Requirements for circuit breakers conforming to the following applications:

- Trip ratings over 600-amp identified as Current Limiting (CLCB) on the Drawings.

a) Integrally fused circuit breaker integrated with solid state static digital electronic automatic trip. Combined standard circuit breaker providing overload-short circuit protection within its interrupting capacity and ON-OFF switching function and on each phase current limiters internally mounted on the load side of the circuit breaker, of such ratings that their time current limiting characteristics will coordinate with the time current tripping characteristics of the circuit breaker elements.

b) The coordination shall result in the interruption by the circuit breaker alone of fault level currents up to the interrupting capacity of the circuit breaker and interruption by the current limiter in conjunction with the circuit breaker of fault level currents above the interrupting capacity of the circuit breaker.

c) A removable cover shall be provided over the current limiter section of the integrally fused circuit breaker. The current limiter housing covers shall be interlocked with the breaker tripping mechanism to insure the breaker will trip upon removal of the cover. The cover shall be interlocked with the breaker to insure the circuit breaker cannot be turned to the ON position with the cover removed. Current limiters shall have a spring loaded plunger which, when the limiter blows, is released to actuate the circuit breaker common trip bar mechanism opening all breaker poles simultaneously.

d) The limiters shall be individually interlocked with the breaker element tripping mechanism to insure the limiter cannot be inserted until the breaker is in the OFF position. The circuit breaker and limiters shall be interlocked to insure the circuit breaker cannot be closed if a limiter is either missing or has blown.

e) Fuse limiters shall be individually removable from the circuit breaker housing.

f) The circuit breaker shall be ambient temperature compensating. The circuit breaker shall be provided with thermal magnetic or solid state static digital trip (depending on the coordination study).

g) The integrally fused circuit breaker shall be capable of interrupting available short circuit currents up to 200,000 RMS symmetrical amperes at voltage up to 600 VAC.

h) Ratings, clearances and performance of the integrally fused circuit breaker shall be in accordance with applicable Standards of NEMA, IEEE and ASA.

2. Switch and fuse feeder tap:

a. Fusible Switches: Quick-make, quick-break type with rejection clips for use with Class "R" fuses. Switches shall be removable from front of equipment without disturbing adjacent units or equipment bus structure.
b. Fuses shall be time delay current limiting types, UL Class RK-1 for motor circuits unless otherwise indicated on the Drawings. Provide one spare set of fuses of each size and type in each switchboard.
c. Provide auxiliary contacts on switch for remote status (on-off) signaling and monitoring.

2.4 MOTOR STARTERS - 50/60HZ AC INDUCTION ELECTRIC MOTORS

A. General

1. Motor starters shall be horsepower rated for the motor connected to the starter, air insulated, with NEMA rating.
2. Motor starter coils and controls shall be designed to operate on the control voltage indicated on the Control Diagrams and Specifications. The motor starters shall reliably pick-up and seal-in at 80% through 110% of their coil control voltage.
3. Under voltage release for motor starter coil circuit shall automatically drop motor starter off the line when the line voltage drops below normal operating voltage. Under voltage release shall be field adjustable 80% to 95% of nominal voltage with field adjustable dropout delay 0.1 to 3 seconds minimum for starters larger than NEMA Size 1. The under voltage release shall reset automatically when line voltage level returns too normal. The reset time delay shall be a 0.1 to 60-second field adjustable time range for starters larger than NEMA Size 1.
4. Each motor starter control circuit shall be independently fused.
5. Three-phase motor starters controlling three-phase motors, five horsepower and larger shall provide integral motor single phasing protection. The starter shall automatically "open", turn off electrical power to the connected motor in the event of the loss of one or more circuit phases, lock out and require manual resetting of the single phase protection to restart the magnetic motor starter. Provide single-phase annunciator. Provide adjustable time delay, minimum range 0.1 to 3 seconds for initiating single phase shut down.
6. Starter units shall be equipped with individual control power transformers (grounded type) with secondary and primary control power fuses. One secondary lead shall be grounded in the unit.

    a. The unit disconnect shall be equipped with a normally open contact to isolate the control circuit from the source when the controller disconnect is open.
    b. The control power transformer VA load rating shall include the motor starter, additional internal and external control devices connected to the motor starter, to insure control power voltage drop does not exceed 5% of nominal rating.

7. Starter units shall be equipped with three motor overload elements, one for each phase, with automatic lockout, external overload indicating flag/pilot light and manual reset external push-button. Trip rating characteristics of the overload elements shall be as recommended by Motor Manufacturer.

    a. Motor overload protection relays shall be bi-metal (non-melting) “heater-element” type or solid-state type, for motor starters NEMA Size 1 and smaller.
    b. Motor overload protection relays for motor starters larger than NEMA Size 1 shall be solid-state type.

8. Pilot light indicators shall be provided with "Push-to-Test" feature. Provide a capacitor in parallel with the starters stop-start control relay circuit, to permit the motor starter control circuit to “drop-out” (turn-

off) and prevent “capacitive-holding” (capacitive coupling) on control circuits with “long” (excessive distance) control circuit wiring.

9. Each starter shall be equipped with a minimum of one normally open and one normally closed auxiliary spare contact. Provide additional auxiliary control contacts for interlocking with system control circuits as indicated on the Drawings and specifications. Auxiliary contacts shall be field convertible for normally open or normally closed operation. Contacts shall be rated not less than 10-amp at 120 volt 60Hz, AC, but in no case shall the auxiliary contacts be rated for less ampere or lower voltage than the connected control circuit.
10. Motor starters larger than NEMA Size 1, provide a running time meter 0 to 99999 hours minimum range, and an operations counter 0 to 9999 meter minimum operations start count range. Meters shall be field resettable with maintained memory during power outages of any length.
11. Minimum starter size shall be NEMA 1, but in no case less than indicated on the Drawings or Specifications.
12. Verify the exact Motor Connection Requirements; motor locked rotor/full load current, NEMA Code letter and voltage characteristics with the supplier of each motor. Motor starters shall comply with the Identified Requirements.
13. Each starter shall be equipped with "Hand-off-Auto" switch or stop-start push-button as required.
14. An auxiliary relay contact for remote alarm annunciation shall provide common trouble annunciation for any of the starter automatic protection systems. The alarm contact shall automatically reset when the starter is reset.
15. Provide each motor starter main "start" control relay or starter coil as applicable, with a magnetic coil auxiliary control “pilot” relay. The contacts of the auxiliary control relay shall directly control the starting, running and stopping control voltage of the motor starter main control coil circuit. The coil of the auxiliary relay shall condition and match the voltage and in rush of each motor starter to the Requirements of the incoming control circuit.
16. Provide a surge protection device for each motor starter coil, to limit voltage transients induced by the motor starter coil operation and to protect the motor starting circuit from voltage transients.
17. Motor starters connected to engine generator emergency power supply source (either direct connection or connection through an automatic transfer switch) shall each be provided with a field adjustable (0.1 - 180 seconds) "start" (on delay) time delay, to provide "staggered" sequenced starting of the connected motor load.

B. Full Voltage Non Reversing (FVNR), Unless Noted Otherwise

1. Across the line full voltage magnetic electromechanical motor starter.
2. Provide FVNR motor starter for motor sizes through 50-horsepower (241 to 600 volt) and through 30-horsepower (240 volt and under) where the motor is connected to normal power utility source, unless noted otherwise on Drawings.

C. Two Speed Motor Starters

1. The two speed motor starters shall be compatible with the connected motor and shall provide automatic two speed control of separate high speed and low speed motor winding or consequent pole two speed motors as applicable. The starters shall be constant horsepower, constant torque or variable torque as applicable for the motor connected to the starter.
2. Low speed compelling control shall compel the motor starter to always start the motor on low speed before switching to high speed. Compelling control shall be manual switch selectable as either "in" or "out" (bypass) of the motor control circuits.

D. Reduced Voltage Non-Reversing (RVNR)

1. General

    a. The reduced voltage starter shall reduce both motor starting current and motor starting torque.
    b. Reduced voltage starters shall be closed transition types.
    c. Provide RVNR motor starters for motors larger than 30-horsepower (240 volt and below) and larger than 50-horsepower (over 240 volts), reduced voltage type (Where the motor starter circuit is connected to engine generator emergency power source for motors larger than five horsepower, provide each respective motor with RVNR reduced voltage motor starters).
    d. Starters shall provide field adjustable time periods for acceleration (reduced voltage) and transition (transfer to full voltage) modes, with failure to transfer lockouts and pilot light annunciators. Adjustable time range shall be 0.1 to 15 seconds.
    e. Duty cycle - NEMA rated medium duty, starters shall provide for not less than one 15-second duration starter operation in each 4-minute interval for a 1-hour period, followed by a cool down rest period of 2-hours before the duty cycle is repeated. Provide automatic temperature lockout to prevent exceeding starter duty cycle.
    f. Reduced Voltage Non-Reversing RVNR Motor starters shall be types described in the following paragraphs.

2. Autotransformer type reduced voltage starter

    a. Auto transformers on each phase with field adjustable transformer voltage taps for 50%, 65%, and 80% motor terminal starting voltages.
    b. Magnetic electromechanical motor contactor type.

2.5 COMBINATION MOTOR STARTERS

A. General

1. Combination motor starters shall consist of a feeder tap device, motor starter and enclosure. Voltage and amperage rating as indicated on Drawings.
2. Combination motor starter shall not be less than NEMA Size 1, but in no case less than indicated on the Drawings.
3. Unit shall be self-contained floor standing, wall mounted NEMA 1 enclosures or as indicated on the Drawings. Constructed, tested and listed in accordance with NEMA, ANSI and UL Standards.
4. Combination motor starters as manufactured by General Electric, Westinghouse, Square D, Cutler Hammer or equal.
5. Provide incoming line and outgoing load terminations, size and capacity to match connections shown.

B. Construction

1. NEMA styles metal enclosed, with full height hinged access door. 12-gauge welded frame members and 14 gauge panel members. All parts shall be removable and accessible from the front for ease of maintenance and rearrangement.
2. Provide removable lifting points and permanent anchor mounting points on the enclosure.
3. Hinged doors shall be mounted with removable pin hinges and secured with quarter turn indicating fasteners. A door interlock with manual defeat override shall prevent access to unit interior when the feeder tap device is in the "on" position.
4. Each metal surface shall be phosphatizing prime rust inhibitor painted and Baked Enamel Finish Painted Manufacturer's standard color.

C. Combination Motor Starter Short Circuit Coordination Protection

The combination motor starter shall be constructed and tested to comply with the Following Requirements.

1. Type 1 Coordination:

   Under short circuit conditions the contactor/motor starter shall cause no danger to persons or installation. Continued re-use shall be permitted after service, repair or replacement of parts.

2. Type 2 Coordination:

   a. Under short circuit conditions the contactor/motor starter shall cause no danger to persons or installation. Continued re-use shall be permitted without requiring any service, repair or replacement of parts.
   b. Motor starters shall also comply with International Electromechanical Committee (IEC) Type-2 short circuit protection, as recommended by the Manufacturer's published protection tables and as certified by UL.

D. Energy Efficient Motor Protection

1. Where a combination motor starter is connected to a high efficiency motor, provide one of the following modifications to the starters or circuit disconnects. The modification shall prevent unnecessary tripping from locked rotor high inrush motor starting current:

   a. Circuit breaker or MCP short circuit protection - Provide Circuit Breaker/MCP with adjustable magnetic current trip for high inrush motor starting current, or adjustable time delay trip for high magnetic current motor inrush damping.
   b. Switch and fuse motor short circuit protection - Provide fuses with sufficient inherent time delay to allow passage of high magnetic current inrush motor starting current.

PART 3 - EXECUTION

3.1 MOTOR CONTROL AND INDIVIDUAL COMBINATION MOTOR STARTERS

A. Install Motor Control Equipment in accordance with Manufacturer's written instructions and applicable portions of NEMA "Standards of Installations" for switchboards and motor control centers and individual motor starters.

B. Bolt Motor Control Equipment to floor and wall where wall exists. Where units are free standing provide preformed steel channel or angle iron bracing to nearest wall or building structural member. Motor control equipment anchoring shall be designed for a 1.0 gravity lateral acceleration of the equipment. Submit structural calculation and details.

3.2 IDENTIFICATION

A. Provide a red and white bake lite nameplate with ½-inch high letters fastened to face of dead-front plate, to read: "DANGER 480 (actual volts) VOLTS, KEEP OUT, AUTHORIZED PERSONNEL ONLY".

B. Manufacturer shall stencil the panel number and name of the connected motor circuit on each device and equipment section to correspond to identification on the Drawing.

C. Identification plates and numbers shall be attached with screws or twist lock fasteners. Adhesive attachment of any kind as the only method of attachment shall not be used.

3.3 SETTINGS AND ADJUSTMENTS

A. Program and Set Control Function Sequences, time delays, and protective device settings for correct system operation.

B. Test all Timing, Control Sequences and motor rotation direction for proper operation. Correct Deficiencies and Retest until proper operation is confirmed.

END OF SECTION 262419
040119/212227

BLANK PAGE

SECTION 263353 – UNINTERRUPTIBLE POWER SUPPLY - UPS

PART 1 - GENERAL

1.1 WORK INCLUDED:

All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for an incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

A. Examine all other Sections for work related to those other Sections and required to be included as work under this Section.

B. General Provisions and Requirements for Electrical Work.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Submit Detailed Shop Drawings including Dimensioned Plans, elevations, details, schematic and point-to-point wiring diagrams and descriptive literature.

B. Submit Transformer Test Reports.

C. System Configuration with Single Line Diagrams, show both internal and external wiring connections on Single Line Diagrams.

D. All Circuit Breakers and Fuses shall be identified by location, frame size, trip rating and Manufacturer with type number, terminal locations and interconnect wiring diagrams. Submit engineered settings for all UPS adjustments, protection devices, time-outs, alarm pickup-dropout, software controls etc.

E. Size and Weight of Individual Shipping Units, weight dimensions and heat dissipation of each unit.

F. Detailed Descriptions of Equipment to be furnished, including all deviations from the Contract Document Requirements.

G. Detailed Layouts of all metering, alarm and mimic panels. Monitoring and metering sensing points shall be shown on the single line diagram.

H. Short Circuit, Coordination and Arc-Flash (Additional Requirements)

1. Perform and submit engineered settings for each equipment location, fuse and adjustable circuit breaker device, showing the correct time and current settings to provide the coordination within the limits of the specified equipment, per the latest applicable standards of IEEE and ANSI. Provide electrical system short circuit fault analysis, both 3-phase line-to-line and 1-phase line-to-ground calculations as part of the Coordination Analysis recommendations. Provide Electric Arc-Flash calculations as part of the Coordination Analysis recommendations.

2. The information shall be submitted in both tabular form and on time current log-log graph paper, with an Engineering Narrative. Written narrative describing data, assumptions, analysis of results and prioritized recommendations, six copies.
3. The goal is to minimize an unexpected but necessary electrical system outage and Personnel exposure to the smallest extent possible within the fault occurrence location, using the specified Contract Equipment. Shall comply with, but not limited to:

    a. IEEE-242, Recommended Practices for Protection and Coordination of Industrial and Commercial Distribution.
    b. IEEE-399, Recommended Practice for Industrial and Commercial Power System Analysis.
    c. IEEE-1584, Guide to Performing Arc-Flash Hazard Study.
    d. CEC

I. Seismic Earthquake and Wind Loading Withstand, Testing and Certification (Additional Requirements).

1. The complete Uninterruptable Power System assembly; including circuit protection devices, inverters, batteries, housings/enclosures, accessories, supports/anchors etc., shall be designed, manufactured and tested.

    a. Wind loading all outdoor equipment locations.
    b. Earthquake Seismic Requirements of CBC Seismic withstand all indoor and all outdoor equipment locations.

2. Shall withstand, survive and maintain continuous non-interrupted energized operation during the seismic event occurrences and wind event occurrences. Continued normal energized operation after the wind event and seismic event occurrences have abated.
3. Shall include demonstrations of successful operation and run test after completion of seismic event shake-table simulation. Acceptance Test Seismic Qualification of proposed UPS equipment shall employ triple axis shake-table simulation of the Required Response Spectrum (RRS) Seismic event motion, Certified and Approved by the AHJ.
4. Provide three dimensional finite element analysis demonstrating anchorage and operational withstand of wind loading not less than as follows and as required by AHJ:

    a. 110MPH-West Coast States USA, California, and Hawaii, per ASCE/SEI 7-10.

5. Seismic test shall be performed by a third party independent Test Laboratory. Wind Analysis and Seismic Testing and Reports shall be Certified, Signed and “Stamped” by PE Professional Engineer Licensed and in good standing in the State, Civil Engineer or Structural Engineer.

1.3 GENERAL

A. Description

1. Each Uninterruptible Power Supply (UPS) system shall provide online double conversion, continuous operation, solid state static, uninterruptible electric power supply and distribution. The UPS shall function as an active electrical power source, electrical power conditioning and active control system in conjunction with the following:

    a. The facility normal (utility) incoming services electrical supply source or sources.
    b. The Direct Current (DC) bus UPS input source.
    c. The facility electrical loads connected to the UPS output

2. The UPS shall automatically provide continuity of electric power within specified tolerances to the UPS output loads, without interruption, including during failure or deterioration of the normal input power supply. Continuity of electric power to the load shall be maintained for an emergency time period with the UPS supplied by battery power up to the specified time and during restoration of the normal utility/ generator power supply.
3. The UPS shall provide 100% continuous conditioned; uninterrupted electric power of the specified limited duration for any combination of linear and nonlinear UPS output loads shown connected to the UPS.
4. Each UPS shall consist of a converter; DC input bus/charger and battery system; solid state inverters; maintenance bypass transfer circuit; controls and monitoring systems; synchronizing systems; circuit protective devices; operating software, and equipment enclosures.
5. UPS Sold State Electronic Components

    a. Digital-Signal-Processing using Pulse-Width-Modulation (PWM) of all UPS control and monitoring functions. Converter and inverter modules shall use Insulated-Gate Bipolar Transistors (IGBT).

6. UPS shall be suitable and recommended by the Manufacturer for operation on normal utility electrical input power and/or standby engine generator supplied input electrical power.
7. The UPS shall protect and correct the electrical supply to loads connected to the UPS resulting from electrical power failures, power sags, over voltages and power surges, frequency variations, brownouts, bidirectional electrical noise, bidirectional high voltage spikes/lightning, bidirectional switching transients, bidirectional harmonic distortion.
8. UPS internal power supplies for UPS controls and fans shall be redundant “hot-swappable” without affecting or disrupting UPS output loads if one power supply fails or is removed for maintenance. Provide power supply failure alarm.
9. UPS equipment shall all be the product of the same Manufacturer.

    a. UPS units, limited to the following pursuant to direction from Owner. As manufactured by Eaton; or APC/Schneider Electric.

B. Standards and Codes

1. The UPS shall be certified to conform, to be designed and to be manufactured to comply with the following Standards and Codes:

    a. Underwriters Laboratory – UL 1778
    b. Canadian Standards Association – CSA 22.2
    c. International Electrotechnical Committee – IEC Semiconductor Converter Standards
    d. International Organization for Standardization – ISO 9001
    e. California Electrical Code – CEC
    f. Federal Communications Commission – FCC Part 15 Subpart-J, Class-A for conducted and radiated noise
    g. Institute of Electrical and Electronic Engineers – IEEE 587, Category A and B.
    h. National Electrical Manufacturers Associates – NEMA PE-1
    i. American National Standards Institute – ANSI 62.41
    j. EIA/TIA – 568B
    k. Local applicable Standards and Building Codes

PART 2 - PRODUCTS

2.1 DESCRIPTION AND OPERATION

A. UPS System Operation

1. The UPS shall operate continuously at described capacity and performances as a continuous on-line automatic system in the following modes to supply rated voltage and kVA output to the UPS connected loads.
2. Modular configuration, providing incremental UPS electrical load and battery capacity expansion of the initial UPS capacity installation.

B. Normal Mode

1. The UPS inverters continuously supplies output to the loads connected to the UPS. Convert the UPS normal input voltage to regulated DC voltage for input to the inverter and simultaneously supply regulated DC as a float charge to the UPS D.C. bus storage batteries.
2. If the DC bus/battery system is disconnected from the UPS for reasons of overload, failure or maintenance of the DC bus/battery system, the UPS shall continue to function and meet all of the specified performance characteristics, for the connected output loads, except the normal input source power outage back-up time capacity for the DC bus/batteries.

C. Emergency Mode

a. Upon failure of the normal input power to the UPS, the inverter shall derive its input from the DC bus UPS battery system and provide continuous uninterruptible power to the loads connected to the UPS output. The transition from UPS normal input power to UPS DC bus battery system shall be accomplished without any switching or coupling and without any interrupting of power to the loads connected to the output of the UPS as a result of either a failure or restoration of the normal input source power to UPS.

D. Recharge Mode

1. Upon restoration of stable nominal normal input power to the UPS, the converter shall automatically reactivate and provide regulated DC voltage for input to the inverter and simultaneously supply regulated DC recharging of the DC bus UPS storage batteries. The recharge process shall occur automatically and without any interruption of the full load output to the loads connected to the UPS.
2. Trickle charge maintain battery recharge with a trickle charge and float charge to full 100% battery capacity. Provide equalizing voltage charge to batteries controlled by the UPS control system.

E. Maintenance – Bypass Mode

1. "Make before break internal bypass switch to provide bypass of normal input power around the UPS to the UPS output loads. The maintenance bypass shall provide electric isolation of the UPS from the UPS normal source input power, the D.C. input bus; inverters/chargers; static switch; and the UPS output loads, without any interruption (make before break) of power to the UPS output loads.
2. The maintenance bypass system shall connect the UPS output loads to:

a. The same UPS normal input power source as the UPS

3. The maintenance bypass system shall automatically insure the bypass input source and load output are synchronized prior to permitting bypass mode operation.
4. The bypass system shall provide for a procedure to electrically and physically isolate the bypass system from the input sources, load output and UPS/inverters – chargers – batteries when the UPS is supplying the output load.

   The isolation shall allow, without any interruption to the output load, inspecting, testing, repair, removal/reinstallation of the maintenance bypass system components, without any possibility of contact with the energized UPS/inverters – charger – batteries and output loads.

5. The UPS/inverters – charger – battery systems shall be electrically isolated and physically separated from the UPS maintenance bypass systems; the input sources; the load output, when the UPS is in the bypass modes. The isolation, without any interruption to the output load, shall allow inspecting, testing, repair, removal/reinstallation of the bypassed components of the UPS without any possibility of contact with the energized UPS maintenance bypass system components and output loads.

2.2 DEFINITIONS

A. Uninterruptible Power System (UPS) - All components within the UPS module cabinet(s), separate battery cabinet(s), load output and bypass modules which function as a system to provide continuous, conditioned AC power to a load.

B. UPS Module Cabinet - Metal enclosure(s) which contain the rectifier/charger, the inverter, the maintenance bypass switches, the external operator controls, and the internal control system required to provide specified AC power to a load.

C. Battery Cabinet - Metal enclosure(s) which contain maintenance free sealed batteries sufficient to maintain UPS output according with the specifications and a battery disconnect circuit breaker.

D. UPS Module - The rectifier/charger and inverter units which, under the supervision of the internal control system and external operator controls, provide specified AC power to a load.

E. Rectifier/Charger - The UPS component which contains the equipment and controls necessary to convert input AC power to the regulated bus power required for battery charging and for supplying power to the inverter.

F. Inverter - The UPS component that contains the equipment and controls necessary to convert DC bus power from the rectifier/charger or the battery to AC power required by the UPS connected output load.

G. Internal Control System - The signal processing circuits which regulate the power conversion processes, detect fault conditions, and control the sequence of operation of the UPS. This term may be shortened to "control system".

H. Operator Controls - The controls, which are used by the operator to monitor and operate the UPS.

I. Maintenance Bypass – the automatic operation device that connects the UPS output load to the UPS input source when the UPS Module and Bypass cannot supply continuous power.

J. Automatic Bypass Static Transfer Switch - The device, which connects the UPS output load to the static bypass line when the UPS Module cannot supply continuous power.

K. Maintenance Bypass Line - The line, which connects electricity directly from the input power to the UPS connected output load during maintenance or whenever the UPS is not operational.

L. Input Power Source - Power provided by the normal utility power source or auxiliary emergency standby engine generator source, which is connected to the input of the UPS.

2.3 ELECTRICAL PERFORMANCE CHARACTERISTICS

A. General

1. Grounding:

   a. The UPS output load neutral shall be electrically isolated from the UPS input source neutral, when the UPS is operating in the normal mode.
   b. The UPS shall be provided with equipment ground terminal bus and neutral terminal bus on each incoming source line side and load output side.
   c. Provide for bonding the UPS load output system neutral bus and ground bus to the incoming source line side neutral bus and ground bus when the UPS is in the Bypass Modes.

2. The UPS shall comply with US Government Agency FCC – Class A RFI Requirements for all operating modes.
3. Input voltages, output voltages, kVA/kW output load rating and phase configurations as shown on the Drawings and specified herein.
4. UPS - Electrical voltage capacities

   a. UPS normal input source lineside voltage 208/120-volt, 3 phase, 4 wire, 60Hz AC grounded.
   b. UPS Maintenance-Bypass input source line side voltage, 208/120 volt - phase, 4 wire, 60Hz AC grounded.
   c. UPS output load voltage 208/120 volt - 3 phase, 4 wire, 60Hz AC grounded.
   d. Refer to Drawings for additional information.

5. UPS - Electrical load capacities

   a. UPS initial output full load capacity as indicated on Drawings.
   b. UPS modular full load output future expansion capacity up to additional 150%.

6. UPS - Electrical load operating DC bus battery capacity continuous time duration at full rated output load not less than 30-minutes.

B. UPS Normal Mode Input (Line Side Source) AC Sinewave, for Constant Rated Output

1. Voltage range tolerance without any DC bus battery discharge or transfer to Bypass Modes: ± 15%
2. 60HZ AC frequency range tolerance without any DC bus battery discharge or transfer to Bypass Modes: ± 5%
3. Reflected input power factor shall never exceed 1.0 (unity) when operating in the Normal Mode or Recharge Mode

   a. At 100% load 0.92 lagging, minimum
   b. At 50% load 0.85 lagging, minimum
   c. When operating in the Bypass Modes the reflected power factor shall track UPS load power factor.

4. Maximum reflected Total Harmonic Distortion (THD) including UPS load contributions

   a. At 100% load 7%
   b. At 50% load 10%
   c. When operating in the Bypass Modes the reflected THD shall track the UPS load THD.

5. Total UPS Efficiency when operating in any mode, including input/output isolation transformer losses:

   a. At 100% load Greater than 92%
   b. At 50% load Greater than 89%
   c. UPS efficiency shall be the measured output KW divided by the measured input kW; with a connected load power factor of 0.8 lagging and the DC bus batteries fully charged operating on-trickle float charge.

6. Maximum magnetizing in rush current:

   a. 1.0Hz maximum or less duration – six times normal full load input current

7. Input Source Load Limits

   a. The UPS shall limit the total normal source input load of the UPS to a value not to exceed 130% of the UPS continuous output kVA full load rating.
   b. The input source load limit value shall include the UPS DC battery recharging loads, DC battery trickle charging loads, UPS full steady state rated output loads and the UPS internal operating losses.

C. UPS Output (Load Side) AC Sinewave

The UPS shall comply with the load output electrical characteristics described below, when the UPS is operating in the Normal Mode, Emergency Mode or Recharge Mode. The UPS load output electrical characteristics shall track the UPS input source lineside when the UPS is operating in the Bypass Modes.

1. Dynamic voltage regulations, from 0kVA to full load rating, phase-to-phase or phase-to-neutral.

   a. Balanced loads ±0.5%
   b. Unbalanced loads ±2%

2. Maximum voltage transient response

   a. 20% output load step ±3%
   b. 50% output load step ±4%
   c. 100% output load step ±5%
   d. Loss or return of AC input voltage ±1%

3. Voltage transient recovery time of rated voltage to within 1%, less than 1.0Hz.
4. Voltage Total Harmonic Distortion (THD) not including connected load harmonic distortion contribution.

   a. 100% linear load 2%
   b. 100% non-linear load 5%

5. Overload capacity while maintaining voltage regulation within ±2% and while maintaining input source load limits.

   a. 125% of full load output for 600 seconds.
   b. 150% for 30 seconds.
   c. 200% for 20 seconds.
   d. 1000% for up to 1-Hz.

6. Manual voltage adjustment ±5%
7. Frequency stability for all specified load conditions, DC bus voltage conditions and temperature conditions

a.	Free running for all load conditions, DC bus voltage conditions and temperature conditions	60Hz ± 0.1% in a 24 hour period ±1% in a 6 month period
b.	Maximum slew rate	0.1HZ per second

8. Maximum Phase to Phase frequency Displacement (Imbalance)

a.	Balanced loads	120 degrees ± 1 degree
b.	100% unbalanced loads	120 degrees ± 3 degrees

9. Connected load power factor 20% lagging to 130% leading for nominal UPS output/input operation.
10. Output synchronization:

    a. The UPS output shall stay synchronized with the automatic bypass input source, if no automatic bypass system is present then maintain synchronization with the manual bypass input source line frequency, provided the static bypass input source line remains within the nominal frequency. Where a bypass is not required to be provided with the UPS, the UPS shall stay synchronized with normal input source.
    b. If the input source line frequency goes outside described limits, the inverter shall break synchronization with the input source line and run on the UPS internal reference frequency. When the input source line frequency returns, within described limits, the inverter output shall automatically re-synchronize with the respective input source line.
    c. The UPS shall be provided with a temperature compensated internal oscillator, to automatically maintain the output load voltage frequency when the input source line voltage frequency exceeds specified limits.
    d. The rate of frequency change (slew rate) shall not exceed 0.1Hz per second.

D. Surge Protection Device and RFI/EMI Protection – (SPD)

The UPS shall comply with the transient voltage surge and RFI/EMI electrical characteristics described below, when the UPS is operating in the Normal Mode, Emergency Mode, Recharge Mode or Bypass Modes.

1. Lightning and Surge Protection Device, Electromagnetic Interference (EMI), and Radio Frequency Interference (RFI) Noise Filtering shall be provided for each UPS. The protection shall function during all UPS Operating Modes.
2. Provide EACH of the UPS source inputs and the load output of the UPS with lightning protection, surge protection device and EMI/RFI protection. The protection shall include functions for common mode and transverse mode; line-to-line (phase-to-phase); each line-to-ground (phase-to-ground); each line-to-neutral (phase-to-neutral) and neutral-to-ground connection protection configurations.

3. RFI and EMI

   a. Conducted line noises interference both EMI and RFI shall be reduced by the UPS over a continuous spectrum of 0.5 MHz to 1.0 MHz.
   b. The basis for reduction shall be a standardized 50 OHM insertion loss MIL –STD-220A Test.
   c. Provide spectrum analysis test, dB attenuation reports showing EMI and RFI filtering over specified frequencies. Test data that is based on calculated or computer simulation is not acceptable.

4. Surge protection device:

   a. Phase-to-phase and grounded "WYE" Performance Requirements

	Characteristics	208/120 Volt
1)	Nominal line to line	208 Volt
2)	Nominal line to neutral	120 Volt
3)	Internal capacitance Microfarads)	2.5
4)	Maximum response time	1-nano second
5)	Minimum EMI/RFI noise rejection	35-45 DB
6)	Nominal peak clamp voltage line to neutral and line to ground	205 volts

   b. Minimum transient energy dissipation per phase (at 8x20 microseconds waveform): 1000 joules
   c. Peak transient withstand (at 8x20 micro-seconds wave-form) without failure of unit, ANSI C642.41: 50,000 amp

      1) Category-C3: 80,000 amp
      2) Category-B3: 60,000 amp
      3) Category-A3: 50,000 amp

E. UPS Short Circuit Withstand and Interrupt Ratings (bolted short circuit fault conditions, symmetrical and asymmetrical).

1. UPS line side input sources shall be "fully-rated" for the short circuit current available at the respective input sources of the UPS as described below, but in no case less than shown on the Drawings. "Series-Rated" with upstream devices is not acceptable for lineside input source devices:

   - 240 volts line-to-ground and below – 42,000 amp RMS symmetrical.

2. UPS internal components shall be "Fully-Rated" or "Series-Rated" to the UPS line side input sources and the UPS load side output, but in no case, less than indicated on the Drawings, and not less than indicated in the time-current short circuit study submittal.
3. UPS load side output shall be "Fully Rated" or "Series-Rated" to the UPS line side input sources, but in no case less than indicated on the Drawings.

F. UPS DC Bus (Battery Source)

1. Maximum D.C. ripple with or without batteries connected to the D.C. Bus

   a. Voltage ± 0.4%
   b. Current 2% RMS

2. Battery voltage shall not vary beyond the following:

   a. Mutual D.C. bus battery shall not exceed 550 volts

3. The D.C. bus battery, end of discharge shutdown, shall be automatically adjusted by the UPS controls for partial UPS output load conditions, to allow for extended operation without damaging the batteries. Automatic shutdown based on discharge time is not acceptable.
4. Battery recharge time from full discharge to 95% recharge shall not exceed 15-times the UPS full load Emergency Mode operating time duration, when the UPS Input Source Load Limit is set at 130%.
5. An automatic battery equalize voltage charge shall initiate after the UPS returns to Normal Mode from any other operating mode. The override of equalize voltage and the time duration shall be adjustable from the UPS Control System.
6. The D.C. bus battery "float" charging voltage shall be automatically temperature compensated for the battery ambient temperature as monitored by the UPS.

   a. Approximate voltage adjustment range: ±25 volt

7. UPS Load Testing of D.C. Bus

   a. Manually initiate from the UPS Control System a reduction of the D.C. bus battery charging voltage to approximately 1.9 volts per cell to force the D.C. bus batteries to carry the UPS load for a limited time.
   b. If a drop in battery voltage occurs indicating diminished battery capacity or battery failure, shall automatically cancel the test and "Alarm" the UPS Control System.

2.4 ENVIRONMENTAL OPERATING CONDITIONS (INCLUDING BATTERIES)

A. General

1. UPS equipment shall maintain a full UPS load and performance without any derating of UPS operation resulting from the ambient conditions described below.

B. Ambient Conditions

1. Normal ambient operating conditions:

   a. Temperature – 20 degrees to 30 degrees centigrade.
   b. Humidity – 30% to 90% non-condensing.

2. Emergency ambient operating conditions:

   a. Temperature 0 degrees to 40 degrees centigrade.
   b. Humidity 5% to 95% non-condensing.

3. Non-operating and storage conditions:

   a. Temperature – Minus 20 degrees to positive 50 degrees centigrade.
   b. Humidity – 0% to 95%

C. Altitude Normal Conditions

1. Operate from sea level to 5,000 feet above mean sea level without derating.
2. Non-operating and storage from sea level to 25,000 feet above mean sea level.
3. Installation location of the UPS exceeding 5000 feet above sea level. The UPS kW and kVA output load ratings and DC Bus battery capacities shall be increased to compensate for the UPS altitude derating recommended by the Manufacturer, to maintain the specified output load capacities of the UPS.

D. Audible Noise

1. Noise generated by the UPS under any condition of specified operation shall not exceed a sound pressure level measured at 5-feet from the nearest surface of the cabinet as follows:

   a. Shall not exceed 65dBA.

2.5 UPS ELECTRICAL CIRCUIT PROTECTION, DEVICES AND DISCONNECTS

A. Protection against External Events

1. The UPS system shall incorporate built-in protection to prevent permanent damage to the UPS and to circuits extending external to the UPS for the following:

   a. Overvoltage, under voltage and overcurrent surges introduced by the primary UPS input sources.
   b. Overvoltage and overcurrent surges introduced on the UPS load output terminals by sources in the load, load switching and fault clearings in the distribution system of the load.
   c. RFI and EMF
   d. Surge protection and lightning surges.

B. Protection against Internal Events

1. The UPS System (including the batteries) shall have built-in protection against permanent damage to itself and the connected load for all predictable types of failures within the UPS.
2. Protective devices shall be provided for power semiconductors, these devices shall be configured to prevent cascading failures.
3. The operation of any protective device shall be detected and displayed by the monitoring diagnostic system of the UPS Control System.

C. Input and Load Output Circuit Protection Devices

1. Device Types 100 amp and Greater Rating
   Multipole gang operated; time overcurrent circuit breakers with field adjustable internal solid state trip protection units, providing long time overcurrent/delay, short time over-current/delay and instantaneous current, trip element adjustable settings and electrical “shunt-trip” operation. Auxiliary annunciator and pilot relay contacts to indicate when the respective device is “Open-Closed-or Tripped”.
2. Device Types under 100 amp Rating
   Same as “100 amp or greater” Requirements or alternately multipole gang operated molded case circuit breakers with fixed non-adjustable thermal-magnetic overcurrent trip elements, adjustable instantaneous trip elements and electrical “shunt-trip” operation. Auxiliary pilot, relay contacts to indicate when the respective devices is “open-closed-or tripped”.
3. Protection devices shall be rated for true RMS voltage operation with loads containing 100% THD harmonic voltage content.

4. Main circuit protection devices for UPS lineside input sources and for load side output shall be motor operated, to allow “on-off” switching control of the protection devices by the UPS Control System.

D. Provide a main circuit protection/disconnect device on each line side input source to the UPS and on each load side output of the UPS. Each device shall be rated for the UPS respective circuit, continuous 100% load ampere input/output rating.

1. Main normal utility source input.
2. DC bus battery input source.
3. Each feeder/branch circuit load output.
4. Maintenance bypass input source and load output.

E. Output Load Branch Circuit Protection

Provide individual branch circuit feeder load side output circuit protection devices for each load connection to the UPS shown on the Drawings. Each device shall be rated to supply the continuous 100% load ampere of the respective connected load without derating.

F. Emergency Power-Off Controls (EPO)

1. The UPS shall be provided with the means of turning off the UPS and disconnecting power to all the UPS input source(s) and the output load both locally and remotely.

   a. Locally - By a single operator switch.
   b. Remote - By the opening of an external customer supplied normally open or normally closed pilot relay contact.

2. Battery fused disconnect switches for manual on-off control of battery output, rated for battery disconnect ampere capacity.
3. UPS equipment “emergency-shutdown” pushbutton key/switch to shut down and disconnect from the UPS all input sources, shut down and disconnect all output loads from the UPS and shut down the entire UPS system. Locate shut down on the UPS equipment.
4. In addition to the UPS “emergency-shutdown” pushbutton located on the UPS, provide a remote UPS “emergency-shutdown” pushbutton for each UPS at each location shown on the Drawings, but in no case less than one remote pushbutton for each UPS, located at each door that provides access into the room occupied by the UPS.

G. Over Temperature Protection

1. Provide internal temperature sensors to monitor temperature of critical UPS components. Upon detection of temperatures in excess of Component Manufacturer's recommended ambient working temperature, the sensors shall cause audible and visual alarms to be indicated on the UPS Control Panel.

2.6 BATTERIES

A. Battery

1. Storage battery unit(s) shall be furnished for the UPS with sufficient capacity to maintain 100% full load operational characteristics and duration in a 25 degree centigrade ambient temperature as specified herein, plus not less than a 5% spare reserve capacity.
2. Battery cell caps shall incorporate hydrogen gas catalytic converter to reduce hydrogen out gassing during battery cycling.
3. The batteries shall be the maintenance free sealed type.
4. The battery containers shall be impact-resistant plastic. Each battery shall be designed for a 10-year life, when maintained under UPS full float charge operation as recommended by the Battery Manufacturer.
5. The batteries shall comply with and be tested per ANSI-N45.2 and MIL-I45208A.
6. The battery cell containers and covers shall be a flame-retardant material; all cells exceeding 0.25 kW per cell storage capacity shall include an integral flash arrestor.
7. The battery load circuit connection terminals shall be rated for the UPS D.C. bus, Recharge Mode, Normal Mode and Emergency Mode operating voltage and current.
8. Battery type:

    a. The battery cells shall be lead-calcium type characteristics, VRLA type.

B. Battery Cabinet

1. All the cells making up the battery shall be installed in a freestanding cabinet, of the same construction as the UPS module cabinet. Battery shelves shall support and organize the batteries and D.C. wiring inside the battery cabinet. The cabinets shall all be of the same height and depth as the other UPS cabinets.
2. Each battery cell shall be held in place to prevent movement during seismic event, as required for Seismic Earthquake Restraints at the location of installation.

C. Battery Disconnect Circuit Breaker

1. Provide each UPS Unit with a DC-battery main circuit breaker. This circuit breaker shall be mounted between the battery output bus and UPS D.C. input bus. When the circuit breaker is open, there shall be no battery voltage present in the UPS module cabinet.
2. The UPS Module shall be automatically disconnected from the battery by opening a motor operated circuit breaker or contactor, when the battery reaches the minimum discharge voltage level or when signaled by other UPS Control Functions.
3. Disconnect shall be rated 600 volt D.C. operation, ampere rating equal to D.C. bus ampere rating and not less than 125% of the maximum DC Bus ampere flow.

D. All battery wiring shall be 600 volt insulated copper conductors.

2.7 CONTROL AND MONITORING

A. General

1. All of the operator controls and monitors shall be located on the front of the UPS Module cabinet.
2. Voltage, current, power, frequency and temperature parameters shall be measured and monitored using true RMS values, within ±1% accuracy.
3. Provide an annunciator lamp push-to-test button to test all annunciator lamps and audible alarms.

B. Controls

1. The startup, shutdown and bypass operations shall be accomplished by a single control switch that will indicate when and in what direction the control switch should be turned.
2. Pushbuttons shall be provided to display the status of the UPS. Pushbuttons shall also be provided to silence, test, set and reset visual and audio alarms.

C. Instrumentation for UPS Units

1. The following alphanumeric digital metering/monitoring information shall be monitored and displayed. A high value alarm, low value alarm and pre-alarm set points shall be field programmable for each metering/monitoring value and maintained in non-volatile UPS storage memory for recall display from memory. Analog to digital converters, current transformers and potential transformers for each instrumentation function shall be provided as part of the UPS system.
2. Each input source and the load output AC-voltage, AC-amperes and total harmonic distortion, line-to-line and line-to-neutral for each phase for:

    a. UPS module.
    b. Each UPS bypass unit.

3. Each input source and the load output-AC power factor, load capacity percentage; AC-frequency, AC-KW and AC kVA for:

    a. UPS module.
    b. Each UPS bypass unit.

4. DC battery bus:

    a. Battery operating capacity and remaining capacity during battery operation.
    b. Total UPS operating time of DC Bus source battery.
    c. DC voltage and ampere.

D. Status and Alarms for UPS Units

1. The following alarms shall be displayed, an audible alarm shall activate when any of the following alarms occur. A visual alphanumeric display or pilot light annunciator shall display each condition. The time, date and duration for each status and alarm shall be maintained in non-volatile UPS storage memory, for recall display from memory. Analog to digital converters, sensors and transponders to sample and monitor each condition shall be provided as part of the UPS system.
2. Power-On, Power-Off and Power-Failed for each input source and load output (AC and DC sources).
3. DC bus

    a. Battery discharging.
    b. Low/high DC Bus voltage.
    c. DC Bus ground fault.
    d. Low battery reserve shutdown.
    e. DC Bus batteries disconnected.

4. UPS loss of synchronization.

5. Temperatures

    a. Equipment over temperature; pre-alarm shutdown.
    b. Over temperature shutdown.

c. Cooling fan failure.
d. Battery over/under temperature.

6. UPS Control Power failed.
7. Each source input and load output:

a. Over, under voltage and loss of voltage.
b. Over and under frequency.
c. Overload warning and shutdown.

8. UPS circuit breakers and circuit protection devices disconnect or fuse open.
9. Rectifier/charger failure.
10. Each UPS Bypass Mode:

a. Load operating on bypass.
b. Bypass input source not available/disconnected.
c. Bypass disabled.
d. Incorrect Bypass phase sequence.
e. Bypass input source and load output not synchronized.
f. Bypass disconnected from the load output.

E. Mimic Panel

1. The mimic panel shall depict a single line diagram of the UPS. Indicating lights shall be integrated with the single line diagram to illustrate the status of the UPS Power paths. The functions whose status is to be displayed shall include, but not be limited to, the following:

a. Each input sources power available.
b. Output load power available.
c. Normal operation.
d. Bypass operation.

2.8 EQUIPMENT DETAILS

A. All Materials and Parts comprising the UPS shall be new, of current Manufacturer, of a high grade and free from all defects and imperfections that may affect UPS correct operation and shall not have been verified in prior service, except as required during factory testing.

B. All Active Electronic Devices shall be solid state. All semiconductor devices shall be hermetically sealed. All control relays shall be dust tight, visible contact position, “socketed” plug-in type.

C. The Maximum Working Voltage, current and “di/dt” of all solid state power components and electronic devices shall not exceed 75% of the ratings established by the respective Manufacturer. The operating temperature of solid state component cases shall not be greater than 75% of their ratings. Electrolytic capacitors shall be computer grade and be operated at no more than 90% of their voltage rating.

D. Wiring

1. Access holes with removable coverplates shall be provided on the top, bottom and sides of the UPS and battery cabinets for inter-cabinet wiring and customer installation wiring connections.
2. All bolted connections of bus bars, lugs and cables shall be in accordance with Requirements of the National Electric Code and other applicable Standards. All electrical power connections shall be torqued to the required value and marked.
3. Provide conductor connection lug landings for lineside input sources, load side output and control system conductor connections to the UPS. Quantity and sizes of conductor lug landings to match circuit conductors and ratings shown on the Drawings.
4. All energized terminals and conductors landing/lugs shall be insulation shielded to ensure that Maintenance Personnel do not inadvertently come into contact with energized parts or terminals.
5. Wire runs shall be protected in a manner, which separate and isolate power from control wiring. Provisions shall be made in the cabinets to permit installation of input, output, and inter-cabinet cabling, using raceway or conduits.
6. Bus for AC line/load voltage current and bus for D.C. current shall be copper; maximum 800 amp per square inch current density based on 100% non-linear loading; continuous extruded insulation over bus with removable insulation “boots” at all screw/bolted bus connections. Bolted connections shall employ “spring-lock-washers”. Silver-plating of bus at all connection locations.

E. UPS Cabinet Housing

1. The UPS shall be contained in NEMA Type I metal enclosures, with key locking hinged metal access doors.
2. Enclosures exceeding 400 pounds shall be anchored to the floor, held in place to prevent movement during seismic event, as required for Seismic Earthquake Restraints at the location of installation.
3. The UPS housing shall be suitable for mounting on a concrete floor or carpeted floor.
4. The UPS shall be structurally reinforced with provisions for hoisting, jacking and forklift handling.
5. UPS cabinet housing segregation:

    a. Provide separate cabinet(s) for each UPS modules, bypass modules and battery modules for UPS units.

6. The UPS cabinets shall be cleaned, primed, and painted with the Manufacturer's standard colors.
7. Adequate forced air ventilation flowing through each UPS cabinet shall be provided to insure that all components are operated within their environmental ratings.

    a. All ventilation fans shall be equipped with “wind- vane” sensors connected to an alarm annunciator on the UPS control system.
    b. Provide removable replaceable air filters on air-cooling, air-intake vents on UPS units with internal cooling fans. Fans shall be redundant operation.

2.9 REMOTE ANNUNCIATOR PANEL

A. General

1. Provide a self-contained wall mounted remote annunciator panel to provide individual indication of the UPS Status and Alarm conditions.
2. The annunciator shall be alphanumeric display.
3. Provide pushbutton to silence the audio alarm with automatic resound.
4. Annunciator shall be flush or surface mount as indicated on the Drawings.

B. Status and Alarm Conditions

1. The remote annunciator shall display the same monitoring, status and alarm information for each UPS as the UPS Control System.
2. The remote annunciator panel shall provide remote control of the UPS from the annunciator panel with operator “password” authorization protection.

2.10 NETWORK COMMUNICATION

A. Communication Interface

1. The UPS shall communicate with the facility computer/data network. Provide Simple Network Management Protocol (SNMP) latest revisions and Management Information Base Protocol (MIBP) latest revisions. The UPS SNMP Agents shall comply with Internet Engineer Task Force IETF-RFC1628 basic and advanced levels standards, compliant software with multi-user site license. The software shall provide computer data network communication.
2. UPS internal network interface card shall provide compatible connection to the network installed at the computer data UPS connection location for "inband" network communication.
3. Provide "out-of-band" communication through RS-232 or USB modem port connection.
4. Communication ports shall be based on EIA/TIA – 568B Standard connections 100 BASE-T copper wire and multi-mode fiber optic communication links.

B. The Software shall operate on each network server and computer workstation node to provide the following monitoring and control functions:

1. Automatic unattended shut down of multiple network servers and multiple stand-alone systems, to prevent data loss after failure of the normal power source and prior to exhaustion of UPS battery storage capacity. Automatically save all data to hard disk drives.
2. Automatic reboot of equipment connected to the UPS power outputs, upon restoration of normal utility power.
3. Notification of normal power loss with broadcast messages to all network connected nodes.
4. Automatic logging of power events to the network servers and workstations and UPS internal event storage memory.
5. Software customizable network shut down and auto boot command sequences, with manager password protection.
6. Provide an internal database of equipment connected to the UPS and provide variable delayed shut down duration of each connected unit.

C. Install and Customize the UPS Software on the Network Servers’ workstations, standalone equipment and UPS Equipment Control System.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation of the UPS shall be in full accordance with UPS Manufacturer's recommendations. Set and calibrate all adjustable settings as recommended by the UPS Manufacturer. Install and connect the UPS to the input sources and load output circuits.

B. Transparent temporary protective plastic covers of suitable gauge shall be provided during installation of the UPS System to protect the entire UPS Equipment from dust and dirt at all times, except while working on a

given module, after which the plastic covers shall be reinstalled. Remove temporary covers prior to placing UPS in operational service.

C. Anchor the UPS Cabinet(s) to the building floor and walls and equipment racks as applicable to hold in place to prevent movement during seismic event, as required for Seismic Earthquake Restraints at the location of installation.

D. UPS Communications

1. Provide complete, copper wire computer data workstation outlet box, and outlet at each UPS location. Provide 0.75 inch conduit with two Category-6A, 4-pair STP twisted pair network data cables complying with EIA/TIA-568B, homerun to nearest computer/data network equipment rack patch panel, or computer data network terminal room closet from each UPS. Provide plug-in RJ-45 connection of UPS to computer data network outlet.
2. Provide outlet box at each UPS and empty 0.75 inch conduit homerun to nearest telephone backboard from each UPS for voice telephone connection to UPS Controls.
3. Provide outlet box at each UPS and two 1.25 inch conduit with conductors recommended by UPS Manufacturer, from UPS to each respective remote UPS Annunciator/Control Panel.
4. Provide outlet box at each UPS and 0.75 inch conduit with 4#14 to each remote EPO.
5. Install, set-up and test UPS Communications Network and Control Software.

3.2 TESTING AND COMMISSIONING

A. General

1. UPS equipment and batteries shall be inspected for damage as soon as they are received. Specifically check to see if wet cell batteries have been turned over in shipment and whether the equipment cabinets have received any severe dents which might cause internal damage. Remove and replace all damaged equipment with new undamaged equipment.
2. Use only the factory provided knock-out areas and conduit entry provisions on the equipment for wiring. Care shall be taken not to let metal slugs or chips get into the equipment cabinet.
3. Prior to energizing equipment, perform measurements on the incoming and load output AC lines to the equipment to insure that the proper voltage level is available and that there are no ground faults or high potentials between conductors or between phase conductor to neutral/ground.
4. Prior to installing the fuses, or closing the circuit breaker in the battery circuit, verify correct battery voltage, polarity markings, battery electrolyte level and all electrical connections are secure.
5. Prior to turning the system on for any tests, the unit shall be bypassed with the mains connected to feed the load directly and the currents in each conductor measured and balanced. Follow Manufacturer’s instructions for installation, connection and energizing equipment.
6. Batteries which are shipped with the electrolyte in the battery cells shall be maintained on a float charger when not installed and energized, operating in the UPS Unit. Batteries shipped without electrolyte installed in the battery cells shall not have electrolyte added until equipment is installed and ready to be energized. Batteries which are not handled with this procedure will be rejected, shall not be used and shall be replaced with new batteries at the Contractors expense.
7. Provide Factory Authorized Field Service Technician factory start-up to Inspect, Energize, Test and Certify the correct system installation, connections and operation. Provide written acceptance Field Service Report, six copies, to Owner's Representative.

B. Provide Full UPS output load capacity and voltage capacity temporary inductive test load banks, 80% power factor and perform full load testing of the UPS after the installation is complete and prior to energizing the building system load circuits connected to the UPS. The UPS shall be cycled through two complete charges

and discharge cycles with the UPS connected to the temporary load bank. Remove the temporary UPS load bank and complete UPS connections after the successful completion of the UPS Verification and of the UPS Compliance with the Contract Document Testing, Performance Requirements.

C. Commissioning (Additional Requirements)

1. Setup, Testing, Startup, and Commissioning shall be performed by Factory Technician(s) Trained, Certified and Authorized by the Equipment Manufacturer. Final Commissioning shall be performed after installation and connections are complete.
2. Provide system programming and setup of all control sequences for the UPS Operation and Control System.
3. Simulate normal source power failure by opening (turn-off) building main service disconnect and verify connections and operation of each electrical system device connected to the system on both normal power source and emergency power sources.
4. Record and document electrical demand load and sequence of operations on the UPS System with all connected loads operating.
5. Test all control system functions after the installation and connections are complete and the system has been energized. Verify each control sequence of operation and each device to be controlled are each operating correctly.
6. Record and document each device setup and program setting.
7. Submit written report (six copies) to Owner's Representative Certifying Commissioning has been performed; all respective systems are operating correctly and document all software setup and each device setting.

3.3 FACTORY SERVICE AGREEMENT (FIRST TWO YEARS OF OPERATION)

A. General

1. Provide site visits and written reports for each UPS at unit start-up, commissioning, and again approximately 12 months after completion of testing and commissioning and again 12-months from there. Shall be included as part of the Base Contract Scope.
2. Factory Authorized Technician shall visit site and startup-test all UPS Options, Accessories and Functions, Physical, Electrical and Mechanical Inspection. Simulate normal source power outage and recharge functions.
3. UPS factory remote monitoring and reporting of each UPS Status, using LAN-Network and/or telephone communications line provided by the Owner.
4. The Base Contract initial first-year-operation Service Scope shall be renewable, if mutual agreement between the UPS Manufacturer and the Owner is accomplished for service cost, scope and renew.
5. Provide three copies of Factory Service Proposal renew Agreement to the Owner's Representative.

END OF SECTION 263353
040119/212227

BLANK PAGE

SECTION 265000 - LIGHTING FIXTURES

PART 1 - GENERAL

1.1 SCOPE

A. Work Included:

All labor, materials, appliances, tools, equipment necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other Specification Sections and Drawings for related work required to be included as work under Division 26.
2. General Provisions and Requirements for electrical work.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. General

1. Submit certification letter from Manufacturers of Lamps and Ballasts and Power/Driver Supplies, (or alternately, Manufacturer's published catalog data) stating/showing the specific lamp, ballast, or power/ driver supply combination comply with Manufacturer recommendation and approval for the combined use, shown on the Drawings.
2. Provide complete Manufacturers catalog data information for each light fixture (luminaire), ballast, power/driver supplies, lamps, materials, auxiliary equipment/ devices, finishes and photometrics.

B. Performance Certification

1. Submit Manufacturer's Certified Test Report data showing compliance with Contract Document.
2. Submit Manufacturer's letter of certification for each fixture type, confirming the proposed combination of specific lamp, ballast, power/driver supply and auxiliary components for each light fixture (luminaire) type will function together correctly and perform in compliance with the Requirements of the Contract Documents as follows:

"The proposed drivers, (where, applicable), lamp sockets and fixture have been tested as an assembly. The proposed fixture products assemblies are certified by the Manufacturer to function within the required temperature, lumen output, electrical characteristics and operational life described in the Contract Documents".

C. Light Fixture Samples

1. If requested by the District’s Representative, provide a sample of each fixture proposed as a substitution for a specified fixture. Sample fixture shall be complete with specified lamps, 3-wire grounding "SO" cord and plug for 120-volt 60Hz, AC plug-in operation. Sample fixtures shall be delivered to the District’s Representative's Office for review, the samples shall be picked up within 10-working days after review comments have been received; any samples left beyond this time will be discarded by the District’s Representative. Decision of District’s Representative regarding acceptability of any lighting fixture is final.

1.3 QUALITY ASSURANCE (ADDITIONAL REQUIREMENTS)

A. Work and Materials shall be in full accordance with the latest Rules and Regulations as follows. The following publications shall be included in the Contract Document Requirements. If a conflict occurs between the following publications and any other part of the Contract Documents, the Requirements describing the more restrictive provisions shall become the applicable Contract definition:

1. UL – Underwriters' Laboratory:

   a. UL – 8750 and 1598C: Light Emitting Diode – LED Equipment for use in Lighting Products and Replacements

2. NEMA – National Electrical Manufactures Association:

   a. NEMA – LE4: Recessed Luminaries Ceiling Compatibility
   b. NEMA – SSL #1, #3 and #6: Electronic Drivers for LED; LED and Incandescent Lamp Replacement
   c. NEMA – LSD #44, #45, #49 and #51: SSL - Solid State Lighting

3. United States Federal Government:

   a. FCC – Part 18: EMI and RFI emissions limitations.
   b. EPA: Energy conservation publications and waste disposal regulations.

4. ETL and C.B.M. certified and approved.
5. Electrical installation standards, National Electrical Contractors' Association:

   a. NEIS/NECA and IESNA – 500: Recommended Practice for Installing Indoor Commercial Lighting Systems.
   b. NEIS/NECA and IESNA – 501: Recommended Practice for Installing Exterior Lighting Systems
   c. NEIS/NECA and IESNA - 502: Recommended Practice for Installing Industrial Lighting Systems.

6. Illuminating Engineering Society – IES (IESNA):

   a. IES – LM41: Photometric and Reporting.
   b. IES – 587: Transient Surge Protection.
   c. IES – LM79: Solid State Lighting (SSL) Testing and Measurement.
   d. IES – LM80: Testing for Lifetime of LED.

7. ANSI-American National Standards Institute:

   a. ANSI – C81
   b. ANSI – C82
   c. ANSI – C62.41: Transient Withstand
   d. ANSI – C78: Lamps

8. State California Code of Regulations - Title-24: Energy Code

PART 2 - PRODUCTS

2.1 GENERAL

A. Complete Fixture

1. Provide light fixtures complete including lamps, drivers, housings, ceiling and wall trim "rings" for each ceiling type, mounting and adapter support brackets, diffusers/lenses and outlet boxes.
2. Include an allowance of $300.00 to provide a light fixture for each lighting fixture outlet shown on Drawings without a fixture type designation.

B. Specific Fixture Requirements and Fixture Schedule Information

1. The catalog numbers included in the description of the various types of lighting fixtures shall be considered to establish the type or class of the fixture with a particular Manufacturer only. The fixture length, number of lamps and lamp types, component materials, accessories, mounting type, ceiling, wall and install adapters, operation voltage, and all other components required to fulfill the total description of the fixture based on all Drawing information, Branch Circuits, Voltages, Specification information, and shall be included in the Contract Requirements regardless of whether or not the catalog number specifically includes these components.
2. Lighting fixtures shall be the types as indicated in Fixture Schedule on the Drawings and as described in the Specifications.
3. All fixtures of the same fixture type shall be the same Manufacturer and of identical finish and appearance, unless indicated otherwise on Drawings.

C. Manufacturer Certification of Operation

1. Lamps and lamp ballasts and power supplies (drivers) shall be recommended and certified by the respective Manufacturer(s), to be "matched" to operate correctly together, within the published characteristics, for efficacy, lamp starting, operating life hours, lumen output, power factor, power input, operating line ampere, sound intensity, and temperature.

2.2 POWER SUPPLIES (DRIVER-POWER SUPPLIES FOR LED-SOLID STATE LAMPS)

A. General

1. All ballast, power supplies, lighting fixtures assemblies and components shall be ANSI, ETL approved C.B.M. Certified and UL labeled.
2. Ballasts shall comply with FCC Part 18 Class-A and NEMA limits as to EMI or RFI and not interferes with normal operation of electrical or electronic data processing equipment.
3. Open circuit voltage, starting voltage, crest voltage and lamp-operating voltage shall comply with Requirements of the respective Manufacturer of the installed lamps.
4. Lamp ballasts, power supplies and transformers shall be for use with the specific lamps provided as part of the Contract.
5. Shall be suitable for use with automatic occupancy motion sensing type switching "on-off" control systems, with multiple "on-off" cycles per hour, on a 24-hours a day basis. Operation shall be without loss of performance in operating characteristics described in the Contract Documents.
6. Fusing

a. Shall be independently fused on the incoming line side within the fixture compartment.
b. Alternately the Ballast Manufacturer may install the equipment fuse inside the ballast/power supply.

c. Provide a label next to ballast cover reading: "Ballast (Power Supply) is fused, check fuse prior to relamping". Provide an additional quantity of 10**%** spare fuses and deliver to District's Representative.

7. Ballast sound rating Class-A or better. Where sound-rating classification is not published, the ballast sound rating shall be the best of product manufactured. Ballasts, which are judged by the District's Representative to be excessively noisy, shall be removed and replaced at the Contractor's expense with low noise ballasts.
8. Electronic solid-state ballasts and power supplies shall be the product of Manufacturer that has been producing electronic ballasts/power supplies for a minimum of five consecutive years prior to the date of the Contract.
9. Shall be designed and supplied to operate on the incoming line voltage system circuits to which the respective light fixtures are connected.
10. Shall not contain any PCB (polychlorinated biphenyl).
11. Power factor shall be not less than 0.90, starting and operating. The input starting transient line input ampere should never exceed lamp normal operating ampere by more than 10%.
12. Ballast and power supply disconnect:

    a. Lighting Fixture Manufacturer factory installed and prewired inside each light fixture, for lamp-ballast or lamp-driver power supply.
    b. Shall comply with UL-2459 and CEC/NEC. Shall disconnect (load-break) energized or de-energized ballast/driver from respective line voltage circuit and dimming circuit. UL-94V-0 flame retardant.
    c. Hot pluggable, multi-pole, insulated connectors, with strain relief and finger-safe squeeze-to-release latching function.
    d. Suitable for available voltage and ampere dimming and non-dimming lamp-ballasts and lamp-power supplies.

13. Ballast and power supplies as manufactured by General Electric, Advance, Philips, Universal, Sylvania/Osram or equal.

2.3 LIGHT FIXTURES (LUMINAIRES)

A. General

1. Lighting fixtures shall have all parts, ballasts, sockets, support attachments, trim flanges and fittings necessary to complete and properly install the fixture at the indicated installation locations. All fixtures shall be provided with lamps of size and type specified.
2. Ceiling and/or wall surface mounted lighting fixtures shall not have any exposed chase nipples or conduit knockouts visible to view within fixture housing. Lighting fixtures mounted in continuous rows shall have chase nipples or conduit knockouts between lighting fixture housing, but shall not have visible chase nipples/conduit knockouts on the visible ends of the continuous row of lighting fixtures.
3. Where fixture color is indicated to be selected by the Architect and/or District's Representative, provide two color chip samples for each color for review.
4. Recessed fixtures with attached junction box shall be provided with a junction box permanently attached to the plaster ring so that the junction box is accessible through the fixture opening when the fixture is removed. Connection between fixture and pull box shall be flexible metal conduit with not less than 16 AWG "AF" or "CF" type fixture rated copper wires, high temperature wire insulation for not less than 600 volts AC. The flexible conduit shall be sufficient length, so that when the fixture is removed, the pullbox is readily accessible.

5. Recessed fixtures shall be Underwriters' Laboratory approved for recessed installation with plaster frame and attached pull box. Lamp enclosure, reflectors and finish wiring shall not be installed until plastering is completed. Exposed finish trim shall not be installed until finish painting of the adjacent surface is completed.
6. The fixture shall bear Underwriters' Laboratory label of approval for the wattage and installation indicated.
7. Light fixtures installed outdoors, in damp or wet locations shall be UL labeled for said location as "damp-location" and "wet-location" for the respective installation location.
8. Fixtures in contact with thermal/building insulation shall be UL listed and rated for direct contact installation in thermal insulation systems.
9. Lamp auxiliary support brackets shall be heat-resistant, non-dielectric. Alternatively, metal auxiliary lamp support brackets shall be electrically isolated from the fixture, to prevent glass decomposition.
10. Lighting fixtures installed in masonry and/or concrete construction. The fixture housing shall be rated for "concrete-pour" installation location.
11. Provide a permanent label inside each light fixture stating the following relamping information. Not less than 0.125-inch high black alphanumeric characters on white background.

    "Replacement lamp(s) installed in this light fixture must comply with the following criteria:

    *: CRI *: Lamp Watts
    : CCT-K: Lamp Lumens

    Only lamp rated * type lamp ballast shall be installed in this fixture."

    *Insert the value required for the specific lamp required by the Contract Documents for each light fixture.

B. Lens and Diffusers

1. Acrylic plastic or Plexiglas for the light fixture diffusers or fixture lenses shall be 100% virgin material.
2. Thickness of not less than 0.125-inch, as measured at the "THINIST" portion on the diffuser or lens. However, thickness shall be increased to sufficient construction and camber to prevent the lens and diffusers from having any noticeable sag over the entire normal life of the installation.
3. Diffusers shall be formed from cast sheet by a vacuum and/or pressure technique.
4. Lighting fixtures containing lamps with dichroic reflectors and light fixtures with non-dichroic lens/ diffuser shall be rated for high temperature lamp operations resulting from lamp heat redirected (reflected) back into the fixture.

2.4 SOLID STATE LIGHTING (SSL), LIGHT EMITTING DIODES (LED) LAMPS, POWER SUPPLIES, AND LIGHT FIXTURES (ADDITIONAL REQUIREMENTS)

A. General

1. Solid State LED light source (lamps), related control equipment (driver-power supply), and luminaire (light fixture) optics for light output distribution.
2. Shall comply with the US-DOE Energy Star Program for SSL-LED. Submit documentation with Shop Drawings.
3. Shall comply with the latest revision IESNA LM-79 and LM-80. Submit documentation with Shop Drawings.
4. SSL chromaticity shall comply with latest revision NEMA and ANSI – C78.377. Submit documentation with Shop Drawings.
5. Submit with Shop Drawings two samples of each light fixture type employing SSL, with prewired 120 volt, 60Hz AC “SO” cord and plug-in cap.

B. LED Lamps

1. Lamp lumen output and overall efficiency shall be based on the LED lamps installed in specified fixture and ambient operating temperature.
2. Lamp Color Rendition Index (CRI) shall equal or exceed CRI – 80, unless noted otherwise on Drawings.
3. Lamp color output shall be 4000-degree K (±100K), unless noted otherwise on Drawings.
4. CRI and lamp color temperature shall be same for all light fixtures of the same fixture type.

C. LED Power Supply (Driver)

1. Combination of power supply and SSL – lamp shall be tested and certified by respective Manufacturers for performance and proper operation.
2. Provide dimming type driver where indicated on Drawings. Driver and dimming equipment shall be Tested and Certified by respective Manufacturers for performance and proper operation.

D. Self-Contained LED Lamp and Driver, Integral "Screw-Base" and/or "Pin-Connect", replacement assembly for incandescent lamps.

1. Shall be dimmable. Dimmer and lamp shall be certified by respective Manufacturers for compatible correct operation with each other.
2. Optical system and operating temperature thermal performance shall be compatible with light fixture.
3. Comply with latest revisions of NEMA LSD-49 and SSL-6.

2.5 EMERGENCY BALLAST LIGHTING AND EMERGENCY DRIVER LIGHTING

A. General

1. Self-contained emergency ballast and power supply (driver) containing batteries, battery charger, solid-state electronic control and lamp/ballast/driver operation, contained within a metal case, red finish case color.
2. UL–924, listed Emergency Lighting and Power Equipment, for installation inside and/or attached to lighting fixtures.
3. The emergency battery supply unit(s) shall be provided inside each respective emergency light fixture by the Fixture Manufacturer.
4. Normal operating temperature range from 0-degrees Centigrade up to operating ambient temperature inside respective lighting fixture, but not less than 50-degress Centigrade.
5. Provide a permanent label inside each emergency light fixture stating as follows, not less than 0.125-inch high black alphanumeric characters on a white background:
   "Warning – this fixture provides more than one electric power source. Disconnect both normal and emergency sources including battery sources prior to opening fixture. Written permanent records documenting regular (every 30 days) emergency lighting function testing results shall be kept on file by the District."
6. UL and Manufacturer rated to supply the lamp and ballast/driver (power-supply) combination occurring in the respective light fixture, both dimming-type and non-dimming type light fixtures.
7. As manufactured by Bodine Inc. or IOTA-Engineering Inc.

B. Operation

1. Emergency mode

When external AC electrical power fails, the emergency unit shall immediately and automatically switch to emergency mode. Maintain emergency lamp(s) illumination, while operating from the internal battery/electronics during the power failure for not less than 90-minutes continuous duration.

2. Normal Mode

   When AC electrical power is restored, automatically switch lamp(s) operation to external AC operation and begin battery-charging mode.

3. Battery Recharge Mode

   The battery charger shall automatically fully recharge discharged batteries in less than 24-hours, and prevent overcharging of the batteries, while maintaining a "float-charge" on the batteries.

4. The emergency battery unit shall operate not less than two lamps in multi-lamp light fixtures and one lamp in single lamp light fixtures. When operating in emergency mode and battery power, the lamp lumen output of each lamp shall be not less than 40% of the lamp normal full lumen output rating of the lamp operation on normal power. The lamp-lumen output shall be 100% of the lamp normal full lumen output rating when operating in normal mode.
5. The emergency ballast shall provide cold-strike start and hot-restrike operation of the fixture lamp(s).
6. Periodic automatic, internal self-test, simulating normal power loss and actual operation of emergency lamps on internal battery power. Auto self-test shall occur not more than 30-day intervals. Audible and visual trouble alarm display, with manual alarm reset/ silence, for problems identified by auto-test functions.

C. Electrical Characteristics

1. Emergency equipment shall operate on the same input AC voltage as the normally "hot" branch circuit supplying the respective light fixture. Maximum line input load shall not exceed 15% more than normal fixture electrical load.
2. The emergency equipment shall be compatible for correct operation with the specific lamp/ballast/ driver combination contained in the respective light fixture.
3. The emergency equipment shall be compatible with switched (on-off), non-switched (continuously on) and dimmer controlled lighting fixtures/circuits.

D. Components

1. Sealed nickel cadmium batteries, maintenance-free, rated for continuous operation in high ambient temperature, with 7 to 10 year operational life expectancy.
2. When standing on the floor below the fixture the emergency ballast test/monitor control panel shall be visible and readily accessible when the fixture is installed. The control panel shall provide:

   a. Charging indicator visual annunciator to display the charger and battery status.
   b. Momentary test switch/pushbutton to manually simulate power failure test.

PART 3 - EXECUTION

3.1 LIGHT FIXTURE INSTALLATION

A. General

1. The Contractor shall verify actual ceiling and wall construction types as defined on the Architectural Drawings and furnish all lighting fixtures with the correct mounting devices, trim rings, brackets whether or not such variations are indicated by fixture catalog number. The Contractor shall verify depth of all recessed lighting fixtures with Architectural Drawings prior to ordering fixtures. Any discrepancies that would cause recessed lighting fixtures not to fit into ceiling shall be reported to the District's Representative prior to release of order to the Supplier of the fixtures.
2. On acoustical tile ceilings, fixture outlets shall be accurately located in the center, at the intersection of the four corners or at the center of the joints of two tiles.
3. The Contractor shall aim the exterior adjustable lighting fixtures after dark in the presence of, and at a time convenient to the District's Representative.
4. Fixtures shall be ordered and furnished to operate correctly on the branch circuit voltage connected to the respective fixture as shown on the Site Plan and Floor Plan Electrical Drawings. The voltages shown on the fixture schedule are for generic fixture information only.
5. Install and connect lighting fixtures to the circuits and control sequences indicated on the Drawings and to comply with respective Manufacturer's instructions/recommendations.
6. Lighting fixtures in building interstitial spaces, in mechanical plumbing and electrical spaces/rooms, are shown in their approximate locations. Do not install lighting outlets or light fixtures until the mechanical, plumbing and electrical equipment/pipes/ductwork are installed; then adjust and install lighting in revised clear (non-interfering) locations to provide best even-illumination. Coordinate the locations with all other trades prior to lighting installation.

B. Lighting Fixtures Installed in Ceiling Support Grids - Suspended Lay-in "T-bar" and Concealed Spline Ceilings.

1. Provide two seismic clips at opposite ends of each recessed light fixture, the clip shall connect to the ceiling grid main runners and the light fixture. The light fixture with seismic clips and ceiling grid runner connections shall resist a horizontal seismic force equal to the total weight of the light fixture assembly.
2. Each light fixture weighing 40-pounds or less and where the respective ceiling grid system is "heavy duty" type, shall be suspended directly from the ceiling grid or shall be suspended independent of the ceiling grid support system as approved by the AHJ. Each light fixture weighing more than 40-pounds or where the ceiling grid system is not a "heavy duty" type shall be supported independent of the ceiling grid and independent of ceiling grid support system.
3. Each light fixture supported independent of the ceiling grid system shall be supported with a minimum of four taut independent support wires, one wire at each fixture corner.
4. Each light fixture supported directly from the ceiling grid or ceiling grid support system shall be additionally connected with a minimum of two independent slack safety support wires. One wire at each opposite diagonal fixture corner. Each 3-feet by 3-feet and larger light fixture shall be supported in the same manner, except provide a minimum of four independent slack safety wires, one at each fixture corner.
5. Light fixtures surface mounted to a suspended ceiling shall be installed with a 1½-inch steel – "C" channel which spans across and above a minimum of two parallel main ceiling grid "runners" and concealed above the ceiling. Each channel or angle member shall be provided with a minimum of two threaded studs for attaching to the fixture housing through the lay-in ceiling tile. Two steel "C" channel members shall be installed for each 4-feet (or smaller) fixture. Install the channels within 6-inches of each end of the light fixture to span a minimum of two ceiling grid parallel main runners. Provide two seismic clips connecting the ceiling grid main runners to each steel – "C" channel. Provide a not less than two taut independent support wires connecting to each channel. Bolt the light fixtures to the threaded studs on the channels or angles, to support the light fixture tight to the ceiling surface.

C. Fixture Supports

1. The support wires for light fixture support shall be 12-gauge steel (minimum). The wires including their building and light fixture attachments shall provide support capacity of not less than four times the weight of the light fixture assembly. Provide additional light fixture support wires and building anchors to meet these Requirements, as part of the Contract. The support wires shall be anchored to the building structural elements above the ceiling.
2. Pendant mounting fixtures shall be supplied with swivel hangers. Fixtures shall swing in any direction a minimum of 45 degrees of gravity, position. Fixtures shall have special stem lengths to give the mounting height indicated on the Drawings. Stem to be single continuous piece without coupling, and to be finished the same color as the canopy and the fixture, unless otherwise noted. The Contractor shall check all lock nuts and set screws to rigidly secure the swivel socket to the stem, and the stem to the outlet box.

   Fixtures shall be plumb and vertical. Where obstructions occur restricting 45-degrees free-swing of fixtures, the fixtures shall be "guy" wired to prevent fixtures from striking obstructions. The District's Representative shall approve method of guying. Swinging fixtures shall have an additional safety hanger cable attached to the structure and the fixture at each support, with the capacity of supporting four times the vertical weight of the light fixture assembly.

3. Suspended fixtures weighing in excess of 40-pounds shall be supported independently of the fixture outlet box. Provide "air craft" (minimum 12 gauge) steel hanger cable for suspended fixtures route cable concealed or in pendant where possible. Each cable attachments shall support four times the weight of the fixture assembly. Securely attach the cable to the building structure.
4. Surface mounted fixtures installed on drywall or plaster ceilings and weighing less than 40-pounds may be supported from outlet box. Provide structural supports above drywall or plaster ceilings for installation of fixtures weighing more than 40-pounds and secure fixture to structural supports. The use of toggle bolts is prohibited.

C. Recessed Lighting Fixtures - Fire Rated Building Surfaces

1. Lighting fixtures recessed in ceiling or wall which has a fire resistive rating of 1-hour or more shall be enclosed in a fully enclosed backbox (except over fixture lens/diffuser). The material used to fabricate the "enclosed backbox" shall have a fire rating equal to that of the respective ceiling or wall.
2. The space from the fixture to the box enclosure shall be a minimum of 3-inches.
3. The backbox shall be concealed behind the fire rated ceiling and wall finish surface. The light fixture shall be provided with lamp ballast rated for (normal light output) operation in a "high" ambient temperature.

3.2 LENS AND DIFFUSERS

Lens, diffusers, internal reflectors shall be completely cleaned of all dust, dirt and fingerprints after the installation of the light fixtures and lamps, and after all trades have completed work and prior to occupancy of the facility by the District.

3.3 COMMISSIONING LIGHTING FIXTURES (ADDITIONAL REQUIREMENTS)

A. General

1. Verify correct lighting control configurations and operation in each room.
2. Simulate normal source power failure by "opening" (turn off) building main service disconnect and verify connections and operation of each emergency lighting fixture.
3. Confirm "EXIT" sign directional arrows are visible in each "EXIT" sign.

4. Verify light fixture support-hangers, ceiling grid clips and seismic restraints comply with the Contract Documents.
5. Remove protective shipping/installation shields on fixtures. Verify fixtures and lamps are clean and free of construction debris. Clean light fixtures found to be contaminated or dirty.
6. Setup, program, and function test lighting control systems to perform each of the indicated control functions, area/room zones and sequences.
7. Provide "aiming", directional adjustment of light fixtures, both indoor and outdoor. Aiming shall comply with Manufacturer's aiming diagrams, and as directed by District's Representative.

B. Sample Spot-Check in each room the following lighting fixture information:

1. Lamp type and performance data.
2. Ballast type and performance data.
3. Combined Lamp/Ballast Certification of performance and compatibility by respective Manufacturer.
4. Verify instructional signage is placed inside each lighting fixture in compliance with Contract Documents.

END OF SECTION 265000
040119/212227

SECTION 265200 – EMERGENCY LIGHTING CENTRAL BATTERY

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other Sections for work related to those other Sections and required to be included as work under this Section.
2. General Provisions and Requirements for electrical work.

B. Demonstration and Instruction (Additional Requirements)

1. Provide on-site instruction classes and operation manuals to the District's Personnel.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. General

1. Submit Manufacturer product data, dimensional data, ambient environmental data and derating factors, electrical performance data.
2. Submit performance and technical information on battery calculations and/or factory tests demonstrating capacity capabilities.

1.3 APPLICABLE STANDARDS (ADDITIONAL REQUIREMENTS)

A. General

1. The equipment shall be listed, labeled and approved for the application show in the Contract Documents, as a battery stored energy, emergency lighting electrical power inverter, complying with the most recent version of the following applicable Standards.
2. The following standards shall become Requirements of Contract Document and are included in the Contract Documents.

B. Underwriters Laboratory - UL

1. UL – 924 and 924A Standard for Emergency Lighting and Power Equipment.
2. UL – 1778 Standard for Uninterruptible Power Supply Equipment.

C. National Fire Protection Agency - NFPA

1. NFPA – 111 Stored Electrical Energy and Standby Power systems.
2. NFPA –70 Article 700 Emergency Systems. (NEC) Article 480 Storage Batteries.

D. Federal Communications Commission - FCC

1. FCC - Class A RFI emission limits.

E. American National Standards Institute – ANSI

1. ANSI – C62.41 both Category-A and Category-B and C62.45 Transient Voltage Withstand.

F. Institute of Electrical and Electronic Engineers-IEEE

1. IEEE – 587 Surge Voltages

G. Seismic Earthquake and wind loading withstand, testing and certification (Additional Requirements).

1. The complete emergency lighting central battery inverter assembly; including circuit protection devices, meter, housings/enclosures, batteries, accessories, supports/anchors etc., shall be designed, manufactured, and tested.

   a. Wind loading all outdoor equipment locations.
   b. Earthquake Seismic Requirements of CBC/IBC Seismic withstand all indoor and all outdoor equipment locations.

2. Shall withstand, survive and maintain continuous non-interrupted energized operation during the seismic event occurrences and wind event occurrences. Continued normal energized operation after the wind event and seismic event occurrences have abated.
3. Shall include demonstrations of successful operation and run test after completion of seismic event shake-table simulation. Acceptance test seismic qualification of proposed equipment shall employ triple axis shake-table simulation of the Required Response Spectrum (RRS) seismic event motion, certified and approved by the AHJ.
4. Provide three dimensional finite element analysis demonstrating anchorage and operational withstand of wind loading not less than as follows and as required by AHJ:

   a. 110MPH-West coast states USA, California, and Hawaii per ASCE/SEI 7-10.

5. Seismic test shall be performed by a third party independent test laboratory, shall include batteries. Wind analysis and Seismic Testing and reports shall be certified, signed and “stamped” by PE Professional Engineer licensed and in good standing in the State, Civil Engineer or Structural Engineer.

H. Short Circuit, Coordination and Arc-Flash (Additional Requirements)

1. Perform and submit short circuit fault current, time/current coordination and Arc-Flash fault engineering analysis, for AC and DC circuits.
2. Provide label equipment with warning and instructional signs.

PART 2 - PRODUCTS

2.1 OPERATION

A GENERAL

1. The Emergency Lighting Battery Unit (ELBU) shall be self-contained, automatic operation. Unit shall store electrical energy and supply standby back-up electrical energy upon failure of normal (utility source) power and provide operation of lighting and other connected equipment as described in the Contract Documents.
2. ELBU shall consist of an automatic circuit transfer system, input/output circuits, storage batteries, battery charger, voltage inverters, monitoring, test/monitoring equipment and operating program software. Manufactured with all components enclosed in modular cabinetry.
3. ELBU volt-ampere continuous load rating shall be sufficient to provide operation of the full unit rated load. But in no case less, than required to supply all of the connected loads shown on the Drawings, plus an additional 20% spare continuous load capacity "Safety·Factor". All at an 80% (0.80) lagging load power factor.

    a. Normal mode load capacity operation duration shall be continuous.
    b. Emergency mode full 100% rated load capacity operation shall be for the duration time indicated on the Drawings, but not less than 90 continuous minutes.

4. Unit shall operate properly in ambient temperatures from 15 to 25 degrees centigrade, sea level to 10,000 feet above sea level, at the specified ratings.
5. Emergency lighting central battery unit shall be as manufactured by Dual-Lite; or Myers Power Products.

B. Operation

1. During operation under normal mode 60Hz AC power, the supply voltage shall feed both the output load and the battery charger. Upon normal power failure, the output load shall be automatically transferred to internal 60Hz AC emergency mode power operation.
2. When normal power is re-established, the output load shall be automatically transferred back to the normal power AC line and the charger shall commence recharging the batteries to their full capacity.
3. Transfer to emergency mode operation shall occur when normal input voltage drops to less than 60% to 70% of nominal for brownout protection on any input line phase. The transfer to emergency mode shall also occur if there is an open circuit, or shorted circuit on the normal input side. A 15 to 60-second transfer time delay (nominal) back to normal mode operation shall be adjustable to reduce "cycling" operation between normal and emergency operating modes.

2.2 LOAD REQUIREMENTS

A. Load Types

1. Load output shall be provided for the following types of loads in any loading combination (0 to 100% of load rating), within the rated capacity (0 to 100% of load rating) for 50% (0.5) lag through 50% (1.5) lead load power factors.
2. Unit shall be suitable for operation and withstand inrush currents associated with the connected loads without damage or changes in its operation including:

    a. Incandescent lamps and ballasts.
    b. Fluorescent lighting fixtures and ballasts.
    c. Electronic equipment including fire alarm equipment.
    d. High Intensity Discharge (H.I.D.) lighting fixtures and ballasts (continuous ARC-sustain operation).

e. Solid state electronic lighting fixture ballasts and dimmers.
f. Electromagnetic lighting fixture ballasts and dimmers.
g. LED (Light Emitting Diode) solid-state lamps and drivers.
h. Fire door holds open devices.

B. Voltage

1. Normal power input and output voltage shall be 60Hz, AC single phase or three phase; 120 volt; 208 volt; 240 volt; 277 volt; 120/208 volt 3-wire or 120/240 volt 3 wire. All as indicated on the Drawings.
2. Provide multiple load output voltages, for both normally on and normally off loads, where indicated on the Drawings (i.e., 120-volt input - 120 volt and 277-volt load output; 277 volt input-120 volt and 277 volt output; etc.).
3. The total line input volt-amperes shall not exceed 135% of the unit rated full load output volt amperes and output line voltage, including battery-recharging loads.

C. Circuit Breakers Line and Load

1. Provide load output circuit breakers, ampacity and quantity as indicated on the Drawings, but in no case less than one 20-amp load output circuit breaker for each 1500 volt ampere (or portion thereof) of unit rated load capacity. Provide the circuit breakers on each normally off and each normally on load out connection and on each load out voltage connection.
2. Provide a unit main line input circuit breaker in the ELBU. The circuit breaker shall be sized to allow continuous full rated load operation of the ELBU, including battery-recharging loads.
3. Provide D.C. battery protection internal breakers.
4. The circuit breakers shall be thermal magnetic molded case type. The Main line input circuit breaker shall be rated a minimum of 42,000-amp symmetrical short circuit interrupting capacity, but not less than shown on the Drawings. Internal and load output circuit breakers shall be “series rated” or “fully rated” to the main input circuit breaker symmetrical short circuit interrupting capacity, at the specified input and output voltage(s).
5. Monitor and trouble-alarm each circuit breaker for "tripped" or "off" condition.

D. Load Output

1. Provide output load types as follows (in any combinations up to unit full rated output capacity).
2. Normally on - Output load is energized in both the normal and emergency modes.
3. Normally off - Output load is energized only when unit is in the emergency mode and de-energized when the unit is in the normal mode.
4. The unit shall function correctly with no load (zero-volt amp) connected to the output terminals. UNITS REQUIRING A MINIMUM CONNECT LOAD FOR CORRECT OPERATION ARE NOT ACCEPTABLE.

E. Load Output Voltage Characteristics

1. During the entire rated operation duration, output voltage shall be sinusoidal wave.

   a. Total harmonic distortion shall not exceed 5% under any combination of the specified load conditions.
   b. Voltage regulation shall not vary more than plus or minus 5% of rated voltage under all load conditions, no load 0% to 100% of full rated load.

2. Load output voltage frequency regulation shall be within plus or minus 0.5Hz under specified load conditions, when operating on the inverter and batteries.

F. Efficiency When Operating In Any Mode

1. At 100% rated load – greater than 97%.
2. At 50% rated load – greater than 94%.
3. Efficiency shall be measured load output kW divided by the measured line input kW; with a connected load power factor of 0.8 lagging and the batteries fully charged operating on trickle float charge.

G. Internal Bypass Switch

1. Switch shall keep all of the loads circuits energized while the ELBU is shut down (bypass) due to malfunction or maintenance.
2. Three position switch: normal; unit bypass; loads off.

2.3 INVERTERS

A. General

1. Inverters shall be modular and completely solid state. Protected against overloads, in rush loads and short circuits.
2. Inverter shall provide stable regulated output operation from the internal batteries under all specified load conditions.
3. Low battery voltage cutout shall be provided to disconnect the inverter load when the battery output voltage drops below a preset value.
4. Automatic unit restart after initiation and/or restoration of normal input power.

2.4 CONTROL, TESTING AND MONITORING EQUIPMENT

A. Internal control, monitoring and testing with programming software and microprocessor control operation shall be provided to verify proper system operation and trouble conditions. Control, testing, and metering display panel shall be installed in the door of equipment cabinet not more than 6-feet-0-inches above finished floor.

B. System Display/Control Panel

1. The system's display panel shall include an array of visual indicators, multi-line alphanumeric character display, and a keypad to control and monitor the system.
2. The array of visual indicators shall monitor and annunciate the AC utility presence, system ready status, battery charging status, battery emergency operation, and alarm functions.
3. The system shall display alphanumeric meter functions including:

    a. Input-voltage and input demand load.
    b. Output-voltage, output-frequency, output-demand load and output-power factor.
    c. Unit internal component temperatures.
    d. Total quantity of power outages and inverter operating time.

4. To ensure only authorized personnel can operate the unit, the system shall be password protected for all control functions, including parametric changes.

C. Alarms

1. The system shall have audible and alphanumeric visual alarm display, with automatic logging of the twenty most recent alarm events. Each alarm will have a corresponding audible signal associated with it to aid in the troubleshooting of the system.
2. The system's alarm acknowledge feature shall enable the user to silence only the current audible alarm(s), while not silencing other alarms and not clearing the alarming condition until the fault has been cleared.
3. Alarms shall monitor low, near low, and high battery voltage; high AC voltage input; high and low AC voltage output; volt-amp output overload; low runtime remaining; high ambient component temperature over limit; check charger, battery, inverter, and memory/logic; emergency power off activated; user test check; and call service.
4. Alarms on each internal circuit breaker, to indicate when the circuit breaker is in the open/off/tripped positions.

D. Manual and Programmable Testing

1. The system shall provide both manual test functions and software programmable automatic test modes. The user shall be able to perform a system test at any time.
2. The system shall also perform an automatic programmable, weekly, self-diagnostic test and load test of its subsystems to insure the system will operate in an emergency condition. A monthly load test for a user programmable discharge time and an annual test for a complete runtime discharge time and an annual test for a complete runtime discharge.
3. Automatic recording in memory, of the last twenty inverter events, including all automatic weekly and user programmed tests, shall be logged.

E. Remote Terminal Strip

1. An auxiliary terminal strip located within the system cabinet shall provide connection points for remote monitoring of inverter status and alarm indication.
2. Remote monitor/annunciator panel:

    a. Provide a remotely mounted ELBU monitoring/alarm panel, with operating status and alarm conditions visual and audible indicators. Provide an audible alarm silence push-button with automatic resound on subsequent alarms.
    b. The panel shall be enclosed in a Nema 1 for indoor locations, NEMA 3R for outdoor locations. Flush mounted housing, with "see-thru" front cover access door. Tamper resistant construction, suitable for installation in unsupervised public areas.
    c. The remote monitoring and alarm panel shall operate over connecting circuit lengths up to not less than 300-foot distance from the respective ELBU.
    d. Provide remote monitoring and alarm panels adjacent to each fire alarm annunciator panel unless noted otherwise on the Drawings.

2.5 BATTERIES

A. General

1. Batteries shall provide capacity to operate the unit and maintain specified inverter output for indicated years on a pro-rata basis when properly maintained as recommended by the Manufacturer.
2. Flame arresting caps shall be provided on batteries, with catalytic conversion to prevent hydrogen out gassing.
3. Battery cases shall be translucent to allow visual observation of electrolyte level. Provide earthquake restraint battery mounting straps.

B. Battery Seismic Restraint

1. Batteries shall be installed in the unit with seismic restraint anchors and straps.

C. Battery Type

1. Batteries shall be nickel cadmium low maintenance type to reduce the need to replenish battery fluids. Batteries shall be 25-year design life expectancy at 77-degrees Fahrenheit ambient, pocket plate construction. Maximum battery discharge shall be automatically limited to the value recommended by Battery Manufacturer of nominal battery voltage, with full rated unit output during discharge.

2.6 BATTERY CHARGER

A. General

1. Battery charger shall be solid state specifically designed for the type of batteries used in the system.
2. Battery charger shall have automatic protection against short circuits, low battery condition, DC-over voltage protection and protected against thermal runaway.
3. Charger shall automatically maintain correct battery charge conditions, with float charging and periodic equalize battery charges, within plus or minus 0.05 volts of Battery Manufacturer's recommendations.
4. The charger shall completely restore fully discharged batteries from the input line source, to full battery charge condition in less than 24 hours.

2.7 CABINET

A. General

1. The cabinetry shall contain all components, inverter, transformers, power supplies, battery charger, including the batteries, free standing with hinged locking door. All components shall be accessible from the front for maintenance and removal.
2. Units requiring side access for cooling air or maintenance shall not be acceptable unless the Drawings specifically show the permitted side access space provisions.
3. Provide water shields on cabinets, to protect the ELBU from fire sprinkler discharge water damage.

B. Cabinet Construction

1. The cabinets shall be metal, NEMA 1 enclosure, equipped with a key-operated access lock.
2. Manufacturer's standard finish color with rust inhibitor "primer" and acid-resistant finish paint.
3. Battery shelves shall permit the batteries to be tested or have battery fluids added without having to remove the batteries.
4. The doors shall open full without affecting the operation of the unit. Conduit knockouts shall be provided on both sides, bottom and top of the cabinet for connection of line and load circuits. Provide dead front or insulated covers over exposed energized parts to prevent accidental contact, when doors are open.

C. Electrical Connections

1. Provide line and load terminal lugs and identification tags on all circuits.

D. Size

1. Maximum cabinet size including batteries shall not exceed those shown on Drawing, but in no case larger than as follows:

   a. Up to 4600VA at 80% power factor rated load output: 43-inches wide by 84-inches high by 21-inches deep.
   b. 4601VA to 11000VA at 80% power factor rated load output: 85-inches wide, by 84-inches high by 24-inches deep.
   c. 11001VA to 17,500VA at 80% power factor rated load output: 128-inches wide by 84-inches high by 26-inches deep.

2.8 COMMUNICATION PORTS

A. General

1. The ELBU shall provide a standard RS-232 bi-directional serial communications port, for communicating with portable computers. Provide software with the ELBU for control, monitoring and diagnostic/maintenance operations of the ELBU. The software shall operate on Microsoft-Windows® based, PC style computers, using 3.5-inches "floppy-disk" magnetic storage media, or 5.25-inch "CD/DVD" ROM.
2. The PC computer is not included in the Contract Scope of Work.

B. Remote Monitoring and Control

1. Facsimile/Modem Communications Panel: Shall automatically transmit system's operating status reports over a dedicated "dial-up" telephone line to remote locations. Provide 1-inch conduit with (ANSI/EIA/TIA-568B) two Category-6, 4-pair, UTP cables and homerun to IDF/MDF telephone terminal.
2. Each designated location shall automatically receive a unit status reports transmission following all monthly and annual test cycles or when an alarm conditions is detected by the system's self-diagnostic electronics.
3. Status reports shall be software programmable and include readings on key operating parameters as well as complete alarm and inverter log printouts.
4. The ELBU Manufacturer shall provide 364 calendar days duration, remote monitoring and supervision of each ELBU. The start date shall begin from the Construction Contract substantial completion date, notice of completion. Provide not less than two written status reports, to the District's Representative, at 180 calendar days and 330 calendar day milestones.
5. The District and Manufacturer shall have the option to renew the Manufacturer's Monitoring Control Contract at a negotiated fair market price and terms, at the end of the initial 364 calendar day periods.

C. Monitoring and Communications Circuits

1. Provide monitoring and communication circuits as follows:

   a. One 0.75-inch conduit, homerun from each ELBU to nearest telephone/data terminal back-board, with two EIA/TIA-568C Category-6A 4-pair UTP communication cables in conduit.
   b. One 0.75-inch conduit, homerun from each ELBU to Building Automation System (BAS) communications transponder, with two EIA/TIA-568C Category-6A, 4-pair UTP communications cables in conduit.

PART 3 - EXECUTION

3.1 TESTING

A. General

1. All units and batteries shall be inspected for damage as soon as they are received. Specifically check to see if wet cell batteries have been turned over in shipment and whether the equipment cabinets have received any severe dents which might cause internal damage. Remove and replace all damaged equipment with new undamaged equipment.
2. Use only the factory provided knock-out areas and conduit entry provisions on the equipment for wiring. Care shall be taken not to let metal slugs or chips get into the equipment cabinet.
3. Prior to energizing equipment, perform measurements on the incoming and load output AC lines to the equipment to insure that the proper voltage level is available and that there are no ground faults or high potentials between conductors or between phase conductor to neutral/ground.
4. Prior to installing the fuses, or closing the circuit breaker in the battery circuit, verify correct battery voltage, polarity markings, battery electrolyte level and all electrical connections are secure.
5. Prior to turning the system on for any tests, the unit shall be bypassed with the mains connected to feed the load directly and the currents in each conductor measured and balanced. Follow Manufacturer's instructions for installation, connection and energizing equipment.
6. Batteries which are shipped with the electrolyte in the battery cells shall be maintained on a float charger when not installed and energized, operating the emergency power unit. Batteries shipped without electrolyte installed in the battery cells shall not have electrolyte added until equipment is installed and ready to be energized. Batteries which are not handled with this procedure will be rejected, shall not be used and shall be replaced with new batteries at the Contractors expense.
7. Provide factory authorized field service technician factory start-up to inspect, energize, test and certify the correct system installation, connections and operation. Provide written acceptance field service report, six copies, to District's Representative.

B. Commissioning (Additional Requirements)

1. Setup, testing, startup, and Commissioning shall be performed by factory Technician(s) trained, certified and authorized by the Equipment Manufacturer. Final Commissioning shall be performed after installation and connections are complete.
2. Provide system programming and setup of all control sequences for the emergency/exit lighting control system.
3. Simulate normal source power failure by opening (turn-off) building main service disconnect and verify connections and operation of each electrical system device connected to the system on both normal power source and emergency power sources. Simulated test time for operating duration connected on the emergency systems shall be not less than 90 continuous minutes without failure or anomalies in the system.
4. Record and document electrical demand load and sequence of operations on the ELBU system with all connected loads operating, including but not limited to:

    a. Fire alarms
    b. Egress/exit lighting
    c. Doors
    d. Auto-loading and overload shedding controls

5. Test all control system functions after the installation and connections are complete and the system has been energized. Verify each control sequence of operation and each device to be controlled are each operating correctly.

6. Record and document each device setup and program setting.
7. Submit written report (six copies) to District's Representative certifying Commissioning has been performed; all respective systems are operating correctly and document all software setup and each device setting.
8. Refer to General Commissioning Section 019113 for Additional Requirements.

3.2 SEISMIC EARTHQUAKE

A. General

1. The entire unit shall be installed and anchored to building structure to comply with Seismic Earthquake Requirements.
2. Install seismic restraints on all batteries.

3.3 FACTORY SERVICE AGREEMENT (FIRST YEAR OPERATION)

A. General

1. Provide site visits and written reports for each ELUB at unit start-up, Commissioning, and again approximately 12 months after completion of testing and Commissioning. Shall be included as part of the Base Contract Scope.
2. Factory authorized Technician shall test all ELUB options, accessories and functions, physical, electrical and mechanical inspection. Simulate normal source power outage and recharge functions.
3. ELUB factory remote monitoring and reporting of each ELUB status, using telephone communications line provided by the District.
4. The Base Contract initial first year operation service scope shall be renewable, if mutual Agreement between the ELUB Manufacturer and the District is accomplished for service cost, scope and renew.
5. Provide three copies of factory service proposal renew Agreement to the District's Representative.

END OF SECTION 265200
040119/212227

SECTION 270536 - CABLE TRAY FOR COMMUNICATION SYSTEMS

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other Sections for work related to those other Sections and required to be included as work under this Section.
2. General Provisions and Requirements for electrical work.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Submit Product Data Sheets for all cable trays, all related components, and NEMA VE1.

B. Submit Cable Tray Support Details.

C. Provide Reproducible Floor Plan Shop Drawings, with the same scale as the Contract Floor Plan Drawings. The Drawings shall show the proposed Cable Tray Layout Plan views. An elevation view shall be provided at each riser or change in horizontal elevation in the cable tray. The Shop Drawing Plans shall show all building elements, expansion/seismic joints, air ducts, piping and components that cross the path of the cable tray, along with separation of the cable tray from the crossing components.

PART 2 - PRODUCTS

2.1 CABLE TRAY

A. Material and installation shall comply with NEMA - "VE1" latest edition, Cable Tray Systems', NEC., California Title 24 and Title 8. As manufactured by Globe Tray, Chalfant, P-W Industries or equal.

B. Cable tray shall include two longitudinal side rails, ladder type, with transverse 6 inches rung spacing welded to side rails. Rungs shall have a minimum cable-bearing surface of 0.75-inches. Rungs shall not extend below bottom of side rails. Splice plates shall be locking bolt type to connect tray sections together without decreased tray strength. Provide expansion/ deflection fitting at each building seismic and expansion joint crossing.

C. Trays shall be steel or aluminum. Steel trays shall be hot dip galvanized after fabrication ASTM A 123 with ANSI type 304 and 316 stainless steel hardware. Aluminum trays shall be extruded from 6063-T6-aluminum alloy with 5052-H32-aluminum alloy hardware.

D. The complete cable tray system and supports shall be designed for the following minimum uniformly distributed working load but not less than indicated on the Drawings, with a 1.5 minimum safety factor, when supported as a single span. In addition, the cable tray shall support 200 pounds concentrated at span midpoint without permanent distortion.

1. Cable tray wider than 12-inches or deeper than 6 inches, live loading 200 pounds per linear foot.
2. Cable tray 12-inches or less in width and 6 inches or less in depth live loading 100 pounds per linear foot.

E. Provide ladder type "elbows", "tees", horizontal "crosses", expansion connectors, reducer sections, connectors, straight sections, curved sections, fittings, supports, hangers, blind ends, risers and accessories to provide a complete installation of the cable tray shown on the Drawings. Provide trapeze brackets and individual threaded hanger suspension rods in any combination required to support the cable tray system. Provide all materials and labor necessary for a complete installation.

F. Cable tray runs shall be minimum 6-inches deep by 12-inches wide, but not less than indicated on Drawings. Dimensions are outside dimensions of the cable tray rails.

G. Similar cable tray parts and hardware shall be interchangeable with each other. The cable tray system shall be free of sharp edges, burrs or projections that can damage cable insulation.

PART 3 - EXECUTION

3.1 CABLE TRAY

A. Cable Trays shall be seismically anchored and supported to the building structure to prevent horizontal or lateral movement with 1.0-gravity acceleration, including specified live load conductor capacity, complying with State of California Seismic Codes. Support hangers from the building structure shall provide a 2.0 weight carrying safety factory including specified live cable weight. Cable tray hangers shall be provided with a spacing to insure the maximum cable tray deflection with the specified live cable loading does not exceed 0.75-inches between supports and hangers. In no case shall cable tray support or hanger spacing be greater than 12-feet on center.

B. Punching or drilling of structural side members shall not be performed except for splice plate bolt-holes.

C. Provide expansion adapters where cable trays cross a building expansion joint, and to comply with Tray Manufacturer's recommendation for the Cable Tray Thermal Expansion Requirements.

D. All Cable Trays including non-connected tray sections shall be made electrically continuous. Provide grounding jumpers minimum equivalent to #8AWG, where required to provide continuity.

E. Grounding for Cable Trays shall comply with Article 318-6 of NEC.

F. Provide curved "radius" cable trays at each "horizontal" or "vertical" change in direction of the cable tray. Provide "tee" and "crosses" at each intersection of Cable Trays. Provide "blind ends" at the end of each cable tray "run".

G. Provide removable fire blocking "bag style" at Cable Tray penetrations of fire barriers.

END OF SECTION 270536
040119/212227

SECTION 270800 - COMMISSIONING OF COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. The Requirements of this Section apply to all Sections of Division 27.

B. This Project will have selected building systems commissioned. The complete list of equipment and systems to be commissioned is specified in Section 019100 General Commissioning Requirements. The Commissioning process, which the Contractor is responsible to execute, is defined in Section 019100 General Commissioning Requirements. A Commissioning Agent (CxA) appointed by the College will manage the Commissioning process.

1.2 RELATED WORK

A. Section 010001 General Requirements

B. Section 010002 General Requirements

C. Section 019100 General Commissioning Requirements.

D. Section 013323 Shop Drawings, Product Data, and Samples.

1.3 SUMMARY

A. This Section includes Requirements for Commissioning the Facility Communications Systems, related subsystems and related equipment. This Section supplements the General Requirements specified in Section 019100 General Commissioning Requirements.

B. Refer to Section 019100 General Commissioning Requirements for more details regarding processes and procedures as well as roles and responsibilities for all Commissioning Team members.

1.4 DEFINITIONS

Refer to Section 019100 General Commissioning Requirements for definitions.

1.5 COMMISSIONED SYSTEMS

A. Commissioning of a system or systems specified in Division 27 is part of the construction process. Documentation and testing of these systems, as well as training of the College's Operation and Maintenance Personnel in accordance with the Requirements of Division 27, is required in cooperation with the College and the Commissioning Agent.

B. The Commissioning shall include the systems listed in Section 019100 General Commissioning Requirements.

1.6 SUBMITTALS

A. The Commissioning process requires review of selected Submittals that pertain to the systems to be commissioned. The Commissioning Agent will provide a list of submittals that will be reviewed by the Commissioning Agent. This list will be reviewed and approved by the College prior to forwarding to the Contractor. Refer to Section 013323 Shop Drawings, Product Data, and Samples for further details.

B. The Commissioning process requires Submittal review simultaneously with engineering review. Specific Submittal Requirements related to the Commissioning process are specified in Section 019100 General Commissioning Requirements.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CONSTRUCTION INSPECTIONS

Commissioning of Communications systems will require inspection of individual elements of the communications system construction throughout the construction period. The Contractor shall coordinate with the Commissioning Agent in accordance with Section 019100 and the Commissioning Plan to schedule communications systems inspections as required to support the Commissioning Process.

3.2 PRE-FUNCTIONAL CHECKLISTS

The Contractor shall complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the checklists. Completed checklists shall be submitted to the College and to the Commissioning Agent for review. The Commissioning Agent may spot check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review. If the Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the type of equipment will be returned to the Contractor for correction and resubmission. Refer to Section 019100 General Commissioning Requirements for submittal Requirements for Pre-Functional Checklists, Equipment Startup Reports, and other Commissioning Documents.

3.3 CONTRACTORS TESTS

Contractor tests as required by other Sections of Division 27 shall be scheduled and documented in accordance with Section 010000 General Requirements. All testing shall be incorporated into the Project schedule. Contractor shall provide no less than 7-calendar days' notice of testing. The Commissioning Agent will witness selected Contractor tests at the sole discretion of the Commissioning Agent. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

3.4 SYSTEMS FUNCTIONAL PERFORMANCE TESTING:

The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady State conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the Resident Engineer. The Contractor shall review and comment on the tests prior to approval. The Contractor shall provide the required labor, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning Agent will witness and document the testing. The Contractor shall sign the test reports to verify tests were performed. See Section 019100 General Commissioning Requirements, for additional details.

3.5 TRAINING OF VA PERSONNEL

Training of the College Operation and Maintenance Personnel is required in cooperation with the College Representative and the Commissioning Agent. Provide competent, Factory Authorized Personnel to provide instruction to Operation and Maintenance Personnel concerning the location, operation, and troubleshooting of the installed systems. Contractor shall submit Training Agendas and Trainer resumes in accordance with the Requirements of Section 019100. The instruction shall be scheduled in coordination with the College Representative after submission and approval of formal Training Plans. Refer to Section 019100 General Commissioning Requirements and Division 27 Sections for additional Contractor Training Requirements.

END OF SECTION 270800
040119/212227

BLANK PAGE

SECTION 271100 — COMMUNICATIONS EQUIPMENT ROOMS

PART 1 - GENERAL

1.1 GENERAL

A. Build-out (installation of racks, cabinets, cable runway, cable management, etc.) of Instructional Building #2, Building-Entry, BDF and IDF shall be provided by the Cabling Contractor.

B. Backboards, conduits, sleeves, power and grounding in the Instructional Building #2, Building-Entry, BDF and IDF shall be provided by the General and Electrical Contractor.

1.2 SECTION INCLUDES

A. Installation of freestanding and wall-mount Equipment Racks

B. Installation of Cable Management — Vertical and Horizontal

C. Installation of wall-mounted 110 Termination Blocks

D. Installation of Backbone UTP Protection Panels and Units

E. Installation of Category 6 UTP Patch Panels

F. Installation of Category 6 UTP Patch Cables

G. Installation of Fiber Optic Patch Panels

H. Installation of Fiber Optic Patch Cables

I. Installation of Grounding

J. Installation of Overhead Cable Runway

K. Installation of Voice Cross-connects

1.3 SYSTEM REQUIREMENTS

A. General: Coordinate the features of materials and equipment so they form an integrated system. Match components and interconnections for optimum future performance.

B. Expansion Capability: Unless otherwise indicated, provide spare conductor pairs in backbone cables, and provide spare positions in cross-connects and terminal strips to accommodate 20% future increase in active services.

1.4 MOUNTING ELEMENTS

A. Pathways: Comply with Section 270528 Pathways for Communications Systems.

B. Backboards: 0.75-inch, ACX interior-grade, fire-retardant-treated plywood painted with two coats of fire-retardant white paint.

C. All free standing racks and cabinets shall be seismically securely to Zone-4 Requirements to the concrete floor using minimum .25-inch hardware or as required by local codes.

D. Racks shall be placed with a minimum of 36 inches clearance from the walls on three sides of the rack. When mounted in a row, maintain a minimum of 36 inches from the wall behind and in front of the row of racks and from the wall at one end of the row.

E. All racks and cable runways shall be grounded to the telecommunications grounding bus bar in accordance with Grounding System Requirements.

F. Rack-mount screws not used for installing patch panels and other hardware shall be bagged and left with the rack upon completion of the installation.

G. Wall-mounted termination block fields shall be mounted on 4 feet by 8 feet by 0.75-inch ACX void free plywood. The plywood shall be mounted vertically 12 inches above the finished floor. The plywood shall be painted with two coats of white fire retardant paint. Wall-mount termination block fields shall be installed with the lowest edge of the mounting frame 18 inches from the finished floor.

PART 2 - PRODUCTS

2.1 TWO-POST RACKS

A. Two-post racks shall have power distribution and cable management for server and networking applications in IT environments.

B. ICT Contractor shall provide, install, ground and seismic brace 2-post racks in the BDF and IDF’s.

C. The unit shall conform to TIA-610 Standard for, Racks, Panels and Associated Equipment and accommodate industry standard 19-inch rack mount equipment.

D. The unit shall be designed with four vertical posts to allow rack mount equipment installation utilizing four vertical mounting rails.

E. The unit shall provide 45U of equipment vertical mounting space (IU—1.75-inch or 44.45mm).

F. The vertical mounting rails shall be adjustable to allow different mounting depths.

G. The unit shall include at least 50 sets of mounting screws, caged nuts, bolts and cup washers, and caged nut installation tool for the mounting of equipment inside the unit.

H. All weight bearing components shall be constructed from steel no less than 0.9mm (20 gauge).

I. All metal parts shall be painted using a powder coat paint process.

l. Racks shall be black over a brushed aluminum finish.

J. Plastic materials shall comply with Underwriters Laboratory Specification 94 with V-1 rating (UL94 V-1) or better.

K. Provisions shall be provided for all rack-mounted equipment to be earthed or grounded directly to the frame.

L. Unit shall include a grounding kit containing terminated green/yellow jumper wires and associated hardware.

M. Units shall be equipped with vertical and horizontal wire management.

N. Racks will require two PDU brackets per cabinet.

O. Freestanding modular aluminum units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.

P. Material:

1. Approximate Module Dimensions: 84 inches high by 19 inches wide by 3 inches channel depth.
2. Racks shall be all high strength, lightweight 6061-T6 aluminum extrusion construction.
3. Racks shall be equipped with two top angles or top bars and heavy-duty assembly hardware.
4. Racks shall have EIA hole pattern on front and rear.
5. Racks shall assemble as 19 inches with no additional hardware.
6. Racks shall have EIA Channel: 3 inches x 1.265 inch x 0.25 inch thick flange.
7. Racks shall have Base Angles: 3.5 inches by 6 inches by 0.125 inch thick (pair).
8. Racks shall have Top Angles: 1.5 inch by 1.5 inch by 0.25 inch (pair).
9. Racks shall have Top Bars: 1.5 inch by 0.25 inch (pair).
10. Racks shall have a weight capacity of 1000 lbs. Weight must be evenly distributed.
11. Racks shall be black over a brushed aluminum finish.
12. Racks shall provide floor and ceiling access for cable management and distribution.
13. Racks shall provide pre-drilled base for floor attachment of rack.
14. Racks shall be seismic/earthquake braced.
15. Racks shall be black in color.
16. Contractor shall provide cable runway elevation kit,

Q. Manufacturer:

1. Chatsworth Products, Inc. p/n# 55053-703
2. Or Equal

2.2 HEAVY DUTY EQUIPMENT SHELF FOR 3-INCHES CHANNEL

A. Shelves, black in color, shall be installed at the bottom of freestanding racks. These 20-inches deep, 200 lb. rated shelves are needed to support UPS units.

B. Manufacturer:

1. Chatsworth Products, Inc.
2. Or Equal

2.3 CABLE RUNWAY (LADDER RACKING)

A. Cable runway support shall be installed in Telecommunications Rooms as shown on the Drawings. Size: 18 inches wide.

B. Classified by Underwriters Laboratories (UL) as suitable for equipment grounding.

C. Cable Runway shall be used for voice and, or data and video communications cabling only. No electrical wiring shall be placed on runway with voice and data cabling.

D. Wall angle supports shall be steel angles. Ends to be smooth without hooks or projections. Brackets shall be able to support an end load of 600 lb. with a safety factor of 1.65.

E. Elbows, Tee's, 90degree bends and crosses: All horizontal and vertical 90 degree elbows, tee's, 90 degree bends and crosses shall be made with right angle couplings which clamp to the runway without the need for drilling or cutting.

F. At all horizontal 90-degree bends, tees, and crosses, provide adjustable junction splice kits for large radius cable bends.

G. Where cables transition from runway to termination equipment or racks, provide cable radius managing waterfall attachments.

H. Seismically supported by end wall supports, angular wall support and communications equipment racks.

I. Protective End Caps on all exposed cable runway ends.

J. Black baked enamel finish.

K. Manufacturer:

1. Chatsworth Products, Inc.
2. Or Equal

2.4 WIRE MANAGEMENT

A. Materials

B. All equipment racks shall be equipped with vertical and horizontal wire management organizers. All horizontal wire managers shall be heavy duty painted black metal units designed specifically to connect to equipment frames. All vertical wire managers shall be aluminum with a black finish. All wire managers shall be secured to the frames and shall provide a clear and unobstructed pathway in which to route the cables.

1. The Vertical cable manager shall be constructed of metal backbone with pass through holes and plastic cable management fingers.
2. The cable management fingers shall be molded out of plastic and incorporate bend radius control throughout the entire length.
3. The panel shall have a metal door that will be capable of opening to the left or right when mounted.
4. The panel shall be capable of mounting to EIA standard channel, deep channel and telco style racks.

5. Vertical wire managers shall be double-sided 4.4 inches wide by 7 feet tall. Vertical wire mangers shall have evenly 1 RMU spaced wire rings designed to maintain jumper, patch, or cross-connect wire in place.
6. Vertical wire managers shall be designed to extend past the frame to allow placement of equipment in any position within the rack. When mounted between equipment frames, they shall be designed to direct cables into either frame and shall be securely mounted to both units.
7. Vertical wire managers shall be equipped with rigid aluminum Switch Gate Door/Cover with reversible access that conceals cable.
8. Vertical wire managers shall be provided black in color.

C. Horizontal Wire Managers (Equipment Racks)

1. The in-frame horizontal managers shall be 2 RMU in height and shall extend from side rail to side rail.
2. Double-sided design and pass-through slots for easy organization of front and rear cables.
3. Include cable guide fingers at 1.75-inch intervals for proper cable bend radius and organization of patch cords.
4. Flanged pass-through slots to route cables to the back.
5. Include Snap-on, hinged door/cover.
6. Black in color.

D. Horizontal Wire Managers (Wall-Mount Brackets)

1. Shall be 2 RMU in height and shall extend from side rail to side rail.
2. Single-sided design.
3. Include cable guide fingers at 1.75-inch intervals for proper cable bend radius and organization of patch cords.
4. Include Snap-on, hinged door/cover.
5. Black in color.

E. Cable Management for Wall Racks

1. Cable management rings shall be installed on wall-mount racks.
2. Black polymer-blend material that is UL Rated for use in plenum spaces.
3. Flexible material holds bundles secure while also allowing easy entrance of additional cables.
4. Internal diameter 3-inches.
5. Kit includes six rings and mounting hardware

F. Manufacturer:

1. Chatsworth Products, Inc.
2. Or Equal

2.5 PLYWOOD BACKBOARD

A. The General Contractor shall provide and install all MPOE and Telecommunications Room backboards.

B. Provide 0.75-inch (19.05 mm) ACX void-free, fire rated plywood as noted on construction documents.

C. All walls noted on Construction Documents must be covered with 0.75 inch (19.05 mm) thick by 8 feet-0 inches (2438.4 mm) high ACX plywood, painted with two coats of insulating fire- retardant white paint.

D. Backboards shall be mounted vertically, starting 6 inches (152.4 mm) above the finished floor, and secured to the walls.

E. All backboards are to be constructed of 4 feet (1219.2 mm) by 8 feet (2438.4 mm) plywood.

F. All plywood panels must be mounted in contact with one another, leaving no gaps between sheets.

G. All exposed edges must be chamfered. Screws, bolts, washers and/or nuts are to be counter sunk to be flush with the surface of the plywood,

2.6 WALL-MOUNTED 110 WIRING BLOCKS

A. Application: Shall be used to terminate voice station and voice backbone cable.

B. Compliance: Comply with ANSI/TIA-568-B.1 and ANSI/TIA-568-B.2 Category 5 Specifications Requirements and associated Addendums, ANSI/TIA-606-B Labeling Standards.

C. All voice station cable terminations shall be made on wall-mounted 110 wiring blocks with C4 connectors.

D. Intra-building voice backbone cable terminations shall be made on wall-mounted 110 wiring blocks with C5 connectors.

E. All blocks shall be UL listed.

F. Characteristics: The 110 Wiring Blocks shall:

1. Facilitate cross-connection and/or interconnection using either cross-connect wire or patch cords.
2. Be manufactured using fire retardant molded plastic with the base consisting of horizontal index strips for termination up to 25-pairs of conductors.
3. Support termination of 22, 24 and 26 AWG solid conductor.
4. Be available in S0-, 100- and 300-pair sizes. Sizes specified within Drawings contain access opening for rear to front cable routing to the point of termination.
5. Have termination strips on the base to be notched and divided into 4-pair and/or 5- pair increments.
6. Have clear label holders with the appropriate colored inserts available for the wiring blocks. The insert labels provided with the basis of circuit size (1-, 3-, 4- or 5-pair) and shall not interfere with running, tracing or removing jumper wire/patch cords.
7. Have bases available in 19-inch (482.6 mm) panels and high-density frame configurations for rack or wall mounting with cable management hardware.
8. Have connecting blocks used for either the termination of cross-connect jumper wire or patch cords. The connecting blocks shall be available in 2-, 3, 4- and S-pair sizes. All connecting blocks shall have color-coded tip and ring designation markers and be single piece construction.
9. Be capable of accommodating a minimum of 200 repeated insertions without resulting in permanent deformation.

G. Manufacturer:

1. AMP
2. Panduit
3. Leviton
4. Or Equal

2.7 PROTECTOR PANELS AND UNITS

A. Application: Inter-building and entrance cable protection will be Vendor's protector panel equipped with protector units. Protector panels shall meet NEC Article 800, Part C Requirements. Protector panels shall provide protection for communications equipment and circuits exposed to voltage surges and sneak currents. The protector panel shall be equipped with 110-style terminations in and out.

B. Protector units shall be UL 497 listed for primary circuit protection. Protector units shall provide protection for communications equipment and circuits exposed to voltage surges and sneak currents. The protector units shall be equipped with solid state surge arrestors for sneak current protection.

C. Manufacturer:

1. Circa
2. Marconi
3. Or Equal

2.8 UTP CATEGORY 6 PATCH PANELS

A. Application: Use to terminate all horizontal data station cabling.

B. Compliance: Listed as complying with ANSI/TIA-568-B.1 and ANSI/TIA-568-B.2 Category 6 Specifications Requirements and associated Addendums, ANSI/TIA- 606-B Labeling Standards.

C. Characteristics: Patch panels shall:

1. Be available in 48-port high-density configurations.
2. Modular Patch Panels shall be of a metal design with snap in four position and six position molded faceplate frames.
3. Patch panels shall be available with labels.
4. Patch panel modular jack assemblies shall be color coded as specified within Section 17140-3.3.
5. Be mountable in freestanding equipment rack.
6. Be labeled above the RJ4S module.
7. Be 2 RMU in height and shall extend from side rail to side rail.

D. Manufacturer:

1. AMP
2. Panduit
3. Ortronics
4. Or Equal

2.9 UTP CATEGORY 6 PATCH CABLES

A. UTP Patch Cables. Patch cables for unshielded twisted pair cable shall be Category 6 rated and shall be equipped with factory-attached connectors to interconnect equipment mounted on the racks of the distribution frame and to connect computer stations to outlet locations.

B. Patch cords may also be used for patching applications; not to exceed 20 feet. Quantity required for 100% port population at both ends with 10% spare.

C. Contractor shall provide:

1. BDF/IDF Patch Cords — 6-inches in length, Category 6 and colored according to the following:

a. Green for instructional network
b. Blue for non-instructional network
c. White for everything else
d. Number of each color to be confirmed with Owner or District Representative.

2. Workstations — 10 feet in length, Category 6, black in color.

D. Manufacturer:

1. AMP
2. Panduit
3. Ortronics
4. Or Equal

2.10 FIBER PATCH PANELS

A. Manufacturer: Ortronics or District approved equal.

B. Provide panel for maintenance and cross connecting of fiber optic cables.

C. Panel shall be constructed of 0.125-inch minimum aluminum and shall have connectors which interface the inside plant fiber optic jumper cable with the outside plant fiber optic cable.

D. Panels shall be equipped with engraved laminated plastic nameplates above each connector.

E. Rack-mounted fiber patch panels shall be equipped to terminate or splice the incoming inter- building fiber and any required backbone or interconnect cables.

F. Each cable must be properly dressed.

G. These units will terminate the fiber optic cables, provide a place for jumper cables and will provide room to terminate additional optics.

H. Panel shall provide capacity for minimum of 12 fiber optic strands. Larger capacity patch panels shall be determined at site walk.

I. Panel shall be 100% populated with type LC couplers and adapter plates.

J. All connectors and couplers will be type LC.

K. The fiber optic patch panel connections shall provide 0.4 dB or less insertion loss.

2.11 FIBER OPTIC PATCH CABLES

A. Manufacturer: Superior Essex, or District approved equal.

B. Fiber Optic Patch Cables shall be Multimode or Single Mode patch cords pre-made to connect fiber optic equipment with fiber optic cross connects, interconnects and outlets.

C. The patch cords (jumpers) shall be impact-resistant, duplex fiber cables with LC connectors, of the same performance characteristics as the Single Mode fiber backbone being connected.

D. These fiber optic patch panel connections shall provide 0.4 dB or less insertion loss and provide connection between the Active LAN devices and the Fiber Optic patch panel. Quantities for 100% fiber strand population at both ends plus 10% Spares.

E. Contractor shall provide:

1. IDF Patch Cords — 1 Meter in length, LC connectorized, Multimode and Single Mode, duplex, fiber optic patch cord.
2. MDF/BDF Patch Cords — 3 Meter in length, LC connectorized, Multimode and Single Mode duplex, fiber optic patch cord.

2.12 GROUNDING SYSTEM

A. The facility shall be equipped with a Telecommunications Bonding Backbone (TBB). This backbone shall be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential to act as a current carrying conductor. The TBB shall be installed independent of the building's electrical and building ground and shall be designed in accordance with the recommendations contained in the ANSI/TIA- 607 Telecommunications Bonding and Grounding Standard.

B. The TBB shall adhere to the recommendations of the ANSI/TIA-607 standard, and shall be installed in accordance with industry best practice.

C. The General Contractor shall be responsible for having a licensed Electrical Contractor provide and install the TBB to the building service entrance ground.

D. The main entrance facility shall be equipped with a Telecommunications Main Grounding Bus bar (TMGB). The Site MPOE and each Telecommunications Room shall be provided with a telecommunications ground bus bar (TGB). The TMGB shall be connected to the building electrical entrance grounding facility. The intent of this system is to provide a grounding system that is equal in potential to the building electrical ground system. Therefore, ground loop current potential is minimized between telecommunications equipment and the electrical system to which it is attached. Installation of building ground systems shall be the responsibility of the Electrical Contractor.

E. All racks, cable runway, metallic backboards, cable sheaths, etc. entering or residing in the MPOEs and Building Telecommunications Rooms shall be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors. Bonding of cable sheaths and equipment within these rooms shall be the responsibility of the Cabling Contractor.

F. All wires used for telecommunications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape. All cables and bus bars shall be identified and labeled in accordance with the System Documentation Section of this Specification.

G. Manufacturer:

1. Chatsworth Products, Inc.

2. Or Equal

PART 3 - EXECUTION

3.1 EQUIPMENT RACKS, SHELVES AND SERVER RACKS

A. Coordinate all work for final mounting locations of all equipment.

B. Provide and install all cable runways as defined on Telecommunications Drawings and Specifications.

C. Provide and install 324-inch fire rated plywood backboards within Telecommunications Room as identified within Telecommunications Drawings and Specifications.

D. Provide and install all equipment racks and cabinets

E. Provide seismic anchoring of all racks and cabinets to meet compliance.

F. Provide and install all vertical and horizontal wire managers.

G. Provide and install required rack-mounted patch panels and wall-mounted 110 termination hardware.

3.2 CABLE MANAGEMENT

A. Provide and install two vertical wire management panels to each 19-inch x 7-feet equipment rack installed.

B. Provide and install one 2U horizontal wire management panel for each UTP patch panel and fiber optic enclosure installed.

3.3 UTP PATCH PANELS

A. Provide and install 48-port, Category 6 patch panels within Telecommunications Rooms.

B. Contractor shall verify and provide exact quantities required.

3.4 FIBER OPTIC PATCH PANELS

A. Provide and install fiber optic patch panels within the building MPOE and Building Telecommunications Rooms.

B. Provide and install necessary adapter and blank panels.

3.5 VOICE TERMINATION BLOCKS

A. Provide and install 110 type termination blocks with wiring troughs within Telecommunications Rooms.

B. Provide lightning protection termination terminals for all outside plant/underground cable installed.

C. Contractor shall verify and provide quantities required.

3.6 CROSS CONNECTS

A. Provide all cross-connect (1 pr. hook-up) wire required in the Instructional Building #1 MPOE and TRs.

B. Backbone cable to backbone cable, cross-connect all pairs.

C. Backbone to voice station cable and emergency telephone cable, cross-connect one pair per station.

3.7 CABLE RUNWAY (LADDER RACKING)

A. Provide and install all ladder rack as defined within the Telecommunications Drawings.

B. Provide and install all required mounting/supporting hardware required.

3.8 TIE WRAPS

Provide and install Velcro cable ties to manage and secure all installed cables within MPOEs and Telecommunications Rooms.

3.9 GROUNDING

A. The Electrical Contractor shall provide and install the Telecommunications grounding system to each MPOEs and Telecommunications Rooms.

B. Provide and install grounding bus bars within MPOEs and Telecommunications Rooms as identified on the Telecommunications Drawings.

C. The Cabling Contractor shall provide and install grounding within BDF and IDF Rooms as follows.

1. Inter-building cable sheaths shall individually bonded to the TGB.
2. Each rack shall be individually bonded to the TGB.
3. Each cable runway section shall be bonded together with ground straps.
4. Cable runway strapped system shall be bonded to the TGB.
5. Ground all equipment within Telecommunications Room with a minimum #6 AWG conductor.

END OF SECTION 271100
040119/212227

BLANK PAGE

SECTION 272000 - ELECTRONIC NETWORK SYSTEMS INFRASTRUCTURE

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other Specifications Sections and Drawings for related work required to be included as work under Division 26.
2. General Provisions and Requirements for electrical work.

B. Provide Electronic Network Systems Infrastructure for the following systems:

1. Computer Data Networks
2. Telephone and Intercom Voice Communications
3. Other special systems described in the Contract documents.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Drawings Submittals

1. Drawings shall be submitted on reproducible sepias and AutoCAD® Version 2.2 (or later revision) data files on CD/DVD-ROM disk, WINDOWS®-XP or Version-7 or Version-8 format.
2. Submit redrawn Building Floor Plan for each building area, same scale as the Contract Drawing.
3. Plans shall show walls, doors, windows, furniture, infrastructure, outlets and network systems equipment locations. Show point-to-point interconnecting cables, pathways, conduit, conduit sizes, circuit types, along with circuit identification names, numbers and quantities between all components.
4. Provide scaled Elevation Drawings of each equipment rack, terminal blocks, terminal backboard and terminal room/closet showing location and arrangement of each equipment component, outlet and cable training provisions, with estimated weight of each complete assembly.
5. Submit block wiring diagrams showing major system components, outlets, equipment racks, terminal blocks, signal loss with interconnecting circuit conductors, splices, portable patch cords and connectors. Riser type diagram shall be provided if the building has more than one floor level, with information shown on riser diagram corresponding for each respective floor.

B. Submit Manufacturer's standard catalog data for each component. The submittal shall be arranged in the order of the Specification and shall list the Specification paragraph number, the name, the proposed model and Manufacturer for each item as well as a reference indicating the specific piece of data which can be easily located in the brochure. The Manufacturer's data sheets shall be marked to indicate the specific item being proposed in cases where the sheet covers several types or sizes of items. The data sheet shall completely describe the proposed item. Where modification to the equipment is necessary to meet the operational Requirements of the Contract Documents, the brochure shall include complete Mechanical and Electrical Shop Drawings, detailing the modification. The brochure shall include a listing of the outlet rough-in Requirements for every device and equipment item. The applicable symbol which illustrates that rough-in item on the job plans shall be drawn on the proposal, opposite the description of the rough-in to facilitate locating the data by Field Personnel. Submit elevation and dimensional information.

C. Performance Calculation:

1. Provide engineered calculations showing the Passive Cable System Signal Attenuation losses of the proposed installed system. The intent is not to require calculations for every system segment, port and outlet. The intent is to require engineered calculations for proposed typical worst case port to port; head end to farthest distance outlet and patch port to outlet signal attenuations.
2. Provide calculations for a minimum of 50 complete channel/circuit paths. The calculations shall include attenuation insertion losses for each system component including individually itemized cable-fiber/wire; outlet, termination, connector, electronic component (if any), coupler and patch cord along the entire path from the head end equipment to the end use outlet.
3. The calculations shall serve as the basis for verifying the system performance with the system testing specified in the Contract Documents.

D. Provide proposed nameplate and outlet identification/color coding system. Indicate proposed identification naming sequence and methods, itemized for review.

E. Submit Manufacturer Certified Test Reports showing test documentation for the proposed material that the material meets or exceeds the performance standards defined in the Contract Documents. The testing and results shall reflect worst case performance based on a minimum of ten samples. Tests shall be certified by a Nationally Recognized Independent Test Lab (i.e., ETL, UL, etc.). The Manufacturer shall certify in writing the material has been manufactured and tested to comply with the Requirements defined in the Contract Documents.

F. Submit three samples of each of the following, fully assembled with 24-inches of cable type connected:

1. Copper wire outlet and connector, with each type of specified inserts.
2. Copper cables and patch cords, each type.
3. Fiber optic cables and patch cord each type.
4. Mechanical splice - fiber optic.
5. Fusion splice - fiber optic.
6. Fiber optic outlet and connector each type.
7. Fiber optic cable connector each type of termination, with interconnection coupler.
8. Patch panel each type.
9. Coverplate each type.

1.3 APPLICABLE STANDARDS

A. Individual component Production/Manufacturer Testing and Labeling.

1. The equipment shall be UL listed, labeled, and approved for the application shown in the Contract Documents.
2. ETL (USA) each network systems infrastructure component. Third party testing, documentation and certification for performance compliance of each component with the UL, ANSI, TIA and EIA applicable Standards specified in the Contract Documents.

B. The complete system material, equipment, testing, installation, workmanship and installed performance shall comply with the Mandatory Requirements and the Guideline/Recommendation Requirements of the following latest published version, supplements, latest revision including Addendums and TSB. Both the mandatory and advisory criteria shall be included as Requirements of the Contract Documents:

1. TIA-526 Optical Power and loss measurements – multimode and single mode fiber.
2. ANSI/TIA/EIA-568C Commercial Building Telecommunications Standards.

3. ANSI/TIA/EIA-569B – Commercial Building Standards for Telecommunications Pathways.
4. ANSI/TIA/EIA-570A Residential Telecommunications Standard.
5. ANSI/TIA/EIA-598B Optical Fiber Cabling Color-Coding.
6. ANSI/TIA/EIA-606A Administrative Standard for Commercial Telecommunications Infrastructure.
7. ANSI/TIA/EJA-607 Commercial Buildings Grounding and Bonding Requirements for Telecommunications.
8. FCC – FYU/FT6.
9. ISO/IEC 11801
10. National Electrical Code (NEC) and California Electrical Code (CEC) including Articles 770 and 800 with ETL verified testing and local code jurisdictions.
11. NECA/NEIS, National Electrical Contractors Association, National Electrical Installation Standards:

    a. 301 – Standard for Installation and Testing for Fiber Optic.
    b. 568-Standard for Installing Building Telecommunications Bonding and Grounding.
    c. 607-Telecommunications

12. Manufacturer's recommendations for the respective equipment.

C. Network Performance

1. The entire completed Electronic Network Systems Infrastructure shall be tested and provide electronic data/network and telephone/voice multi-channel communications latest revisions, standards and addendums for the following protocols:

    a. IEEE 802.3/ETHERNET latest revisions.

2. Twisted pairs copper wire (100 meter path length unless indicated otherwise)

    a. 10Mbps 10Base-T, 100Mbps 100Base-Tx;
    b. 1000Mbps (1Gbps) 1000 Base-Tx;
    c. 10,000 Mbps (10Gbps) 10Gb Base-Tx.
    d. IEEE-802.3 for Power Over Ethernet (POE) and Power Over Ethernet-Plus (POE Plus).

3. Fiber optic, 550 meter communications pathway distance, OM4 standard multimode and OS2 single-mode.

    a. 10Mbps 10Base-F1, 100Mbps 100Base-FX,
    b. 1000Mbps 1000Base-Lx-Sx
    c. 10,000 Mbps (10Gbps) for fiber optics
    d. Single Mode path length performance increase Requirement to 3000 meters.

4. IEEE 802.5/TOKEN RING.
5. APPLETALK (Phone-net).
6. FDDI - Distributed data interface on fiber or copper wire, 100Mbps.
7. 100VG – Any LAN
8. TIA/EIA serial and Bi-directional RS-232 and RS-485, including Star-Hub repeaters.
9. ANSI - TPPMD 55Mbps, 155Mbps and 622Mbps Asynchronous Transfer Mode - ATM.

D. The Complete Telephone/Voice Infrastructure System shall be suitable for the telephone/voice analog and digital communications and VoIP protocols. The system shall be compatible with the telephone/voice equipment installed as part of the Contract.

E. Installation of All Infrastructure Equipment, Devices, Splices, Terminations, Cables, Outlets, etc. shall comply with Manufacturer's recommendations.

1.4 EQUIPMENT QUALIFICATIONS

A. Equipment

1. The Supplier of the equipment shall be the Factory Authorized Distributor and service facility for the brands of equipment and material provided.
2. Network systems infrastructure equipment and materials shall all be the product of one of the individual same Manufacturers as follows. Typical unless specifically described otherwise:

   Belden – 10GX Series; or CommScope-Systimax X10D Series;
   or AMP/Tyco – NetConnect Series;
   or Ortronics/Legrand – NetClear Series;
   or Siemon – ConvergeIT Series.

B. Installation Certification

1. Work and material for cables, cable terminations, outlets and related components for infrastructure systems shall be performed by Certified Installers. The Installer shall be certified by the respective Product Manufacturers.
2. The Manufacturers of the indicated work and material shall provide an Installer education/training and certification program for the supplied products.
3. The Installers performing the Contract Work for the indicated products shall have attended and successfully completed each of the respective Manufacturer's installation training education programs for the specified products.
4. Submit six copies of the Manufacturer's Certifications for each installer performing the work. The submittal shall be approved by the Owner's Representative prior to initiating any related Contract Work.
5. Contract material installed and work performed by Installers not complying with these Requirements shall be removed. Removal of work and material not in compliance with these Requirements shall done at the Contractor's expense, without any additional cost to the Contract and without any additional Contract completion due date extensions. New material and work required to replace the non-complying removed work and material shall be provided at the Contractor's expense, without any additional cost to the Contract and without any additional Contract completion due date extensions.

C. Extended Material and Performance Warranties

1. In addition to the Warranty Requirements described elsewhere in the Contract Documents, provide the following extended material and performance warranties. The warranty period shall be for not less than 15-years from the Contract Notice of Completion.
2. Warranty scope includes materials and performance for network cables and terminations, network workstation plug-in outlets, and patch panel plug-in outlets, cable splices and connectors.
3. Repair or replace the defective material with new material at the Project premise, to comply with the performance standards outlined in the Contract Documents during the warranty period.
4. Submit seven copies of proposed warranty statements, with Shop Drawing submittals.

1.5 ABBREVIATIONS

Abbreviation	Terminology
ACR	Attenuation to Cross Talk.
AHJ	Authority Having Jurisdiction.
Backbone	Circuit interconnections between MDF and IDF patch panel locations.
dB	Decibel.
dBm	Decibel referenced to a milliwatt.
Demarc	Demarcation location where operational control change occurs or ownership change occurs.
ft.	Feet.
GHz	Gigahertz.
Gbps	Gigabits per second.
Horizontal Connection, and/or Horizontal wiring	Circuit interconnections between individual workstation outlet location to respective IDF or MDF equipment rack patch panel.
IDF	Intermediate Distribution Frame (horizontal or vertical cross connect) for an individual building area/ floor.
km	Kilometer-lkm.
kPSI	1000 pounds per square inch.
m	Meter = 39.37 inches.
Mbps	Megabits per second.
MDF	Main Distribution Frame (central/main cross connect) for multi-building site or for a single individual building.
MHz	Megahertz.
MIC	Micrometer
mm	Millimeter = $l0^{-3}$ meter.
NEXT	Near end cross talk.
nm	Nanometer = 10^{-9} meter.
pF	Picofarad = 10^{-12} farad.
Provide	Furnish, install and connect.
RTDE	Equipment rack mount fiber optic termination distribution enclosure, with fiber optic patch panel.
RMSE	Equipment rack mount fiber optic enclosure, splice only (without patch panel).
STP	Shielded individual twisted pairs copper wire.
ScTP	Shield Screened Twisted Pairs copper wire.
Trunking-Cable	Individually insulated twisted pair copper wire cable, consisting of 24-pair or more of conductors inside a common cable jacket. Terminate and connect to common terminal-block location at each end of the trunking-cable.
um	Micrometer = 10^{-6} meter.
USE	Universal Splice Enclosure.
UTP	Unshielded twisted pairs copper wire.
VoIP	Voice communications Over Internet Protocol.
WGNA	Wide Band Gigabit Networking Alliance.
Workstation or Workstation location	Spaces remote from the MDF/IDF terminal room/closet, where user equipment interacts and connects with the electronic systems infrastructure equipment connection outlet device.
WMIC	Wall Mount fiber optic cable Interface Cabinet.

1.6 MATERIALS AND METHODS

A. Material and Labor not complying with the Contract Documents shall be removed by the Contractor from the Project Site. Material and labor complying the Contract Documents shall be provided.

B. All the cost to remove deficient work and material, provide work and material complying with the Contract Documents and the direct, indirect, incidental damages and Contract delays resulting from complying with these Requirements shall be the sole responsibility of the Contractor and shall be included in the bid price.

C. System Performance Requirements

1. The work, performance and type of materials provided as part of the Contract shall comply with the following ANSI/TIA/EIA-568C and related standards for all Electronics Network Systems Infrastructure work and materials described in the specifications and shown the Drawings:

   a. Computer/data network systems: Category-6
   b. Telephone/intercom voice systems: Category-6

2. The Electronic Network Systems Infrastructure system shall be based on “star-topology”; for MDF to IDF backbone connections and workstation outlet to MDF/IDF horizontal connections.

PART 2 - PRODUCTS

2.1 FIBER OPTICS CABLES

A. General

1. Operating temperature range - 20 degrees centigrade through +60 degrees centigrade. Cables shall be flame retarding.
2. Electronic network systems infrastructure cables that are not installed inside conduit raceways. Electronic network systems infrastructure cables that are installed in concealed spaces including plenums and non-plenums; access floors, ceiling spaces, walls, floor, etc., and/or installed without continuous raceways. The cable insulation and jacket shall be listed and labeled “Limited Combustible Cable” (LC or LCC) and shall comply with the latest published revision of all of the following Additional Requirements.

   a. Limited combustible “FHC-25/50” per UL-2424.
   b. NEC/CEC;CMP, additional listing/labeling where the install location is an environmental air plenum, fiber optic “FHC-25/50-CMP and/or OFNP/OFCP”.
   c. NFPA-90A; ceiling cavity plenums, wall cavity spaces and raised floor cavity plenums, limited-combustible.
   d. NFPA-5000; defines combustible material including wire and cable.
   e. NFPA-75 computer rooms and electronic equipment room.
   f. NFPA-13; spaces containing “limited combustible loading”.

3. Cables shall qualify as 100% recyclable materials disposal, RoHS Regulation complaint.
4. All fibers in a multi-fiber cable shall be fully operational within the performance characteristics specified prior to and after the cable is installed. The use of spare fibers in the cable to compensate for defective fibers is not permitted. Defective cables shall be removed and replaced with fully functional cables at no additional cost to the Contract.

5. Cables shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with Specified Requirements. ANSI/TIA/EIA-568C including related Standards, Amendments and TSB.
6. Each fiber shall be individually identified with factory color-coding or factory imprinted label. The outer cable jacket shall be imprinted with date, Manufacturer's model and catalog number, along with Agency listing identification.
7. Fiber optic cable shall be a product of the same Manufacturer, including portable patch cables.
8. Cables installed in raceways or conduits below grade, through in-grade manholes or pullboxes shall be rated for installation in water/wet locations.
9. Provide overall outer jacket enclosing all fibers inside jacket. Cables containing less than seven fiber strands shall be provided with a color coded outer jacket (red or orange).
10. Multimode (62.5/125)

    a. Fiber optic cables optical fibers, (62.5/125) graded index multimode optical glass fibers, 62.5 micron fiber core and 125 micron fiber cladding, 0.275 numerical aperture. Optical fibers shall be 100 kpsi proof tested, with maximum 0.7 micron flaw size for dual operation at 850nm and 1300nm wave lengths.
    b. Minimum bandwidth:
       @ 850nm - wave length 160MHz per km length
       @ 1300nm - wave length 500MHz per km length
    c. Maximum attenuation:
       @ 850nm-wave length 3.4 dB @ 1km length
       @ 1300nm-wave length 1.0 dB @ 1km length
    d. Laser-optimized "OM2" optical multi-mode standards.

11. Multimode (50/125)

    a. 50/125 fiber optic cables optical fibers, graded index multimode optical glass fibers, 50.0-micron fiber core and 125-micron fiber cladding, 0.2 numerical apertures. Optical fibers shall be 100 kPSI proof tested, with maximum 0.7 micron flaw size for dual operation at 850nm and 1300nm wave lengths.
    b. Minimum bandwidth:
       @ 850nm-wave length 3500Mhz per km length
       @ 1300nm-wave length 500Mhz per km length
    c. Maximum attenuation:
       @ 850nm-wave length 3.0db @ 1km length
       @ 1300nm-wave length 1.0db @ 1km length
    d. Laser-optimized "OM4" optical multi-mode standards.

12. Single mode:

    a. Fiber optic cables optical fibers, (8.3/125) single mode optical glass fibers, 8.3-micron core fiber and 125-micron fiber cladding, 0.11 numerical apertures. Optical fibers shall be 100-kPSI proof tested, with maximum 0.7-micron flaw size. For operation at 1310nm and 1550nm wave lengths.
    b. Maximum attenuation:
       @ 1310nm- wave length 0.5 dB @ 1km length
       @ 1550nm- wave length 0.4 dB @ 1km length

    c. Maximum dispersion
       @ 1310nm- wave length 2.8 ps/nm km length
       @ 1550nm- wave length 18.0 ps/nm km length
    d. Laser-optimized "OS1"/OS2" optical single mode standards.

B. Loose Tube Gel-filled Cables

1. Multiple, loose tube buffer tubes, gel-filled. Each buffer tube shall contain the same quantity of optical fibers, but not more than twelve optical fibers in each buffer tube.
2. Buffer tubes shall be cabled around a central dielectric strength member. The central strength member shall be centered along the length of the cable.
3. Aramid yarn, non-optical, strength fibers shall extend continuously along the length of the cable.
4. The cable interstitial spaces shall be flooded to inhibit water migration, with non-flammable water blocking gel.
5. Each optical fiber shall be individually UV cured acrylate coated, 250-micron diameter coating over fiber cladding.
6. A seamless black polyethylene outer layer jacket shall envelope the entire cable.
7. The cable shall be fungus resistant, UV resistant, and moisture resistant for installation indoors with or without an enclosed raceway and outdoors in underground enclosed raceway/conduit and manholes/ pullboxes continuously flooded with water.

C. Indoor/Outdoor Cables

1. The cable shall be fungus resistant, UV resistant, moisture resistant for installation indoors with or without an enclosed raceway and outdoors in underground enclosed raceway/conduit and manholes/ pullboxes continuously flooded with water, and in conduits exposed to the sun.
2. Each optical fiber shall be primary coated with 500 micron uniform acrylate tight buffered and with elastomeric uniform 900-micron diameter tight buffered, secondary coating. Aramid yarn strength member elements shall be tensioned and symmetrically and uniformly distributed around the fibers, along the length of the cable.
3. An overall cable jacket uniformly extruded directly around and mechanically interlocked with the optical fibers/strength members. The extruded jacket shall form internal helical cusped ridges that interlock with the optical fibers and strength members. The interlocking jacket shall not allow cable fibers to move axially within the cable jacket.
4. Cables containing more than twenty-four optical fibers shall be constructed with sub-cable fiber bundles. Each sub-cable bundle shall contain equal quantities of optical fibers, with a separate PVC jacket around each sub-cable. Sub-cable and sub-cable jacket construction shall match the Overall Cable Requirements and Jacket Requirements.
5. The cable shall be UL listed and comply with NEC and NFPA Requirements for each installation location shown in the Contract Documents. ETL tested and certified to comply with or exceed Specified Requirements.

    a. NEC – OFNR (Vertical Riser Type Locations) OFNP (UL FHC-25/50 LC Plenum Type Locations and locations where not continuously enclosed inside conduits for entire cable length).
    b. NEC – OFNG (Where continuously enclosed inside conduits for entire cable length).

D. Tight Buffered Cables

1. Each optical fiber shall be coated, 900-micron diameter uniform coating, with uniform tight buffering over the coating, uniform dielectric strength member surrounding the buffering coating and an overall jacket around each optical fiber assembly.
2. Individual multiple optical fiber assemblies shall be symmetrically arranged around a central dielectric strength member. The central strength member shall be centered along the length of the cable.
3. A dielectric strength member shall surround the fiber assemblies.
4. An outer dielectric jacket shall envelope the entire cable.

5. The cable shall be UL listed and comply with NEC and NFPA Requirements for each installation location shown in the Contract Documents. ETL tested and certified to comply with or exceed Specified Requirements.

    a. NEC - OFNP (UL FHC-25/50 LC Plenum type locations and locations where not continuously enclosed inside conduits for entire cable length).

2.2 COPPER WIRE CABLES (TWISTED PAIRS)

A. General

1. Conductors shall be copper wire, individually insulated and color coded, with multiple conductors arrange in twisted pairs.
2. An overall non-conductive jacket shall encase the copper wires and any shielding (where shielding is specified) shall also be encased by the jacket.
3. Cables shall be UL listed, complying with NEC National Electrical Code, National Fire Protection Agency and NFPA Requirements for each installation location shown. ETL tested and certified to comply with or exceed Specified Requirements.

    a. NEC – MPP/CMP, FHC-25/50 (Plenum type locations and locations where not continuously enclosed inside conduit).
    b. NEC – MPR/CMR (Vertical riser type locations).
    c. ANSI/TIA/EIA-568C; including related Standards, Amendments and TSB.

4. Electronic network systems infrastructure cables that are not installed inside conduit raceways. Electronic network systems infrastructure cables that are installed in concealed spaces including plenums and non-plenums; access floors, ceiling spaces, walls, floor, etc., and/or installed without continuous raceways. The cable insulation and jacket shall be listed and labeled “limited combustible cable” (LC or LCC) and shall comply with the latest published revision of all of the following Additional Requirements.

    a. Limited combustible “FHC-25/50” per UL-2424.
    b. NEC/CEC;CMP, additional listing/labeling where the install location is an environmental air plenum, copper wire “FHC-25/50-CMP”.
    c. NFPA-90A; ceiling cavity plenums, wall cavity spaces and raised floor cavity plenums, limited-combustible.
    d. NFPA-5000; defines combustible material including wire and cable.
    e. NFPA-75 computer rooms and electronic equipment room.
    f. NFPA-13; spaces containing “limited combustible loading”.

5. Cables shall qualify as 100% recyclable materials disposal, RoHS regulations complaint.
6. Cables installed in air plenums, air-handling spaces and cables installed without raceway or conduit shall also be UL listed and labeled for installation in air plenums.
7. Cables installed in raceways or in conduits below grade, or through in-grade manholes and pullboxes, shall be rated for installation in water/wet locations.
8. The outer cable jacket shall be imprinted with date, Manufacturer’s model and catalog number and Agency (AHJ) listing identification.
9. Copper wire Electronic Network Systems Infrastructure cable shall be a product of the same Manufacturer, including portable patch cables.

10. The outer jacket of cables with less than nine pair of conductors shall be color-coded. The jacket color shall be different for each system type; multimedia; telephone/voice; computer/data network; and fiber cable jackets.
11. 300-volt RMS insulation material for each data conductor shall be the same material; shall be the same electrical characteristics and shall be the same dielectric constant, for all data conductors contained within the respective common cable jacket, along the entire installed length of the cable. Data cables employing differing insulation materials for individual data conductors contained within a common cable jacket are not acceptable and shall not be provided.
12. Propagation and "Skew" Rate

    a. Skew rate (nominal velocity of propagation delay) between any twisted pair in a combination of 4-twisted pair conductors grouped in the same cable, shall not exceed 35-nano seconds between any wire pair contained in the conductor group, and as required by the cable Category rating, over a cable length of 328-feet (100 meters), for all frequencies up to the cable maximum frequency rating.
    b. Nominal velocity of propagation, exceeding 70% of the speed of light.

13. Large capacity feeder cables and trunking-cables

    a. Copper wire cables with more than 24-twisted pairs of conductors shall be constructed with 25-pair binder groups of conductors. The cable binder groups shall be enclosed in colored binders and assembled to form a single cable. The twisted pair/binder groups shall be enclosed with multi-layer dielectric protective sheaths underneath a cable jacket enclosing the entire cable assembly. A corrugated metal 100% shield shall be provided under the cable jacket enclosing all conductors.
    b. Cables shall be wet location rated and listed for installation in conduit, where the conduit is in a wet environment and/or high-temperature environment, including:

        · Underground conduit.
        · Inside manholes and pull boxes.
        · Outdoor conduit exposed to weather and/or sunlight.

    c. ANSI/TIA/EIA Category rating of cable assembly shall be Category-5E, trunking-cable.

B. Category-6 Computer/Data Enhanced Cables – [ScTP] [UTP]

1. Category-6 cables shall be tested and shall pass the ANSI/TIA/EIA Test recommendations for Category-6.
2. Operation Characteristics:

a.	Wire size	23AWG solid copper (23AWG stranded copper for portable patch cables)
b.	Quantity of twisted pairs	As indicated but in no case less than 4-twisted pairs
c.	Impedance	100 OHM ± 15%, 1-500Mhz
d.	Maximum Signal Attenuation Per 328-feet (100 meters)	2.1dB @ 1Mhz 3.8dB @ 4Mhz 5.9dB @ 10Mhz 7.5dB @ 16Mhz 8.4dB @ 20Mhz 10.5dB @ 31.25Mhz 15.0dB @ 62.5Mhz

19.1dB @ 100Mhz
27.6dB @ 200Mhz
31.1dB @ 250Mhz
34.3dB @ 300Mhz
40.1dB @ 400Mhz
45.3dB @ 500Mhz

e. Mutual Maximum Capacitance of Any Pair 4.4nF/100m

f. Worst Pair "NEXT" Loss Per/328-feet (100 meters)

67.0dB @ 1Mhz
67.0dB @ 4Mhz
67.0dB @ 10Mhz
67.0dB @ 16Mhz
67.0dB @ 20Mhz
67.0dB @ 31.25Mhz
65.6dB @ 62.5Mhz
42.3dB @ 100Mhz
58.0dB @ 200Mhz
56.5dB @ 250Mhz
55.3dB @ 300Mhz
53.5dB @ 400Mhz
52.0dB @ 500Mhz

3. ScTP, all the wires in the cable shall be enclosed in a common, 100% metallic foil shield with copper "drain" wire, shield and drain wire located under the cable jacket.

2.3 FIBER OPTIC FIBER SPLICES

A. General

1. Fiber optic cable splices shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements, ANSI/TIA/EIA–568C including related Standards, Amendments and TSB.
2. Fiber optic splices shall be the product of the same Manufacturer.

B. Mechanical Splice

1. Mechanically splice each fiber with a splice suitable for use with the type of fiber optic fibers. Re-enterable and reusable splice. Splice shall be recommended as compatible with the optical fibers by the Manufacturer. Splice shall not require the use of adhesives. Splice shall provide integral strain relief.
2. Performance Requirements after installation:

a. Operating temperature range minus 20-degrees centigrade through plus 60-degrees centigrade.
b. Loss variation over temperature range, 0.05dB or less at specified wave lengths.
c. Insertion loss, 0.3dB or less at specified cable wave lengths.
d. Reflection (return loss), -40dB at specified cable wavelengths.

C. Fusion Splicing

1. Fusion splicing shall be performed with equipment providing the following features:

a. Cleaving and cleaning optical fiber.
b. Integral splice optimization verification system with local injection and detection.
c. Projection screen optics and fiber core alignment system.
d. Fiber cleaning/stripping.
e. Cleaning fiber ends and fusing of fiber together with an electric arc.

2. Fusion splice insertion loss as measured at the completion of the splice shall be less than 0.1dB at specified cable wave lengths.

2.4 FIBER OPTIC FIBER CONNECTORS AND INTERCONNECTION COUPLERS

A. General

1. The connectors and interconnection couplers shall be compatible, maintain the same Performance Category rating and be compatible with the corresponding fiber optic cable type attached to the connectors.
2. Fiber optic cable connectors and interconnection couplers shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements. Connectors and couplers shall comply with ANSI/TIA/EIA-568C, related Standards, Amendments, TSB, and TIA/EIA-Fiber Optic Connector Intermateability Standard (FOCIS) documentation.
3. Fiber optic connectors and couplers shall be the product of the same Manufacturer.
4. Shall be UL listed and comply with UL94V-0.
5. Color code connectors for fiber optic cables to match the respective fiber optic strand/jacket color.

B. Fiber Optic Fiber Connectors

1. LC – Small Form Factor (SFF) termination connector

a. Ceramic oxide 1.25mm ferrule. Mechanical durability not less than 500-mating cycles. Insertion loss of mated connector shall be less than 0.3dB at specified wavelengths.
b. Strain relief boot, long boot type unless indicated otherwise, short or angled boot type to match the connector installation application. Provide duct cover cap for each connector.
c. Locking type to automatically align mating fibers in the fiber cable and prevent accidental rotation and pullout.

2. ST type bayonet termination connector

a. Ceramic aluminum oxide 2.5mm ferrule, multi-cure ultra violet or heat cured epoxy bonded, for multimode or single mode to match cable fiber. Insertion loss of each mated connector shall be less than 0.3dB at specified wavelengths.
b. Strain relief boot, long boot type unless indicated otherwise, short or angled boot type to match the connector installation application. Provide dust cover cap for each connector.
c. Locking type, to automatically align fiber cable and prevent accidental pullout.

3. SC – Square/Subscriber termination connector

a. Ceramic oxide 2.5mm ferrule.
Insertion loss of mated connectors shall be less than 0.3dB at specified wavelength.
b. Strain relief boot, long boot type unless indicated otherwise, short or angled boot type to match connector installation application. Provide dust cover cap for each connector.

c. Push-pull snap and lock type to automatically align mating fibers in the fiber cable and prevent accidental rotation and pullout.

4. "FSD" fixed shroud duplex type termination connector

C. FIBER OPTIC FIBER INTERCONNECTION COUPLERS

1. Interconnection couplers shall be “like-to-like” compatible, and shall provide "plug-in" coupling of two fiber optic cable connectors terminated with fiber optic fibers front-to-rear "in-line" together. The coupler shall provide interlocking, automatic optical self-alignment of two mating fiber optic connectors.
2. The centerline to centerline spacing of the interconnection couplers shall allow removal and insertion of portable patch cords, fiber cable connectors for both “single” and “duplex” type fiber adapter connectors without interfering with adjacent connectors.
3. Patch panel mounted interconnections couplers shall be factory pre-mounted to a modular nominal 0.09-inch thick metal panel, couplers aligned and anchored on the plate.

   a. The metal panel shall be predrilled for Standard EIA mounting in high-density 19-inch wide metal patch panel frames.

4. Interconnection couplers in workstation outlets shall be installed in outlet boxes with cover plates.
5. Provide removable dust caps for the front side of each coupler.

2.5 COPPER WIRE OUTLET CONNECTORS

A. General

1. Connectors shall comply with FCC part-68 Subpart F for gold plating.
2. Connectors shall be UL listed and shall comply with UL94V-0.
3. Provide a removable blank dust cover for each plug-in outlet insert. The dust cover shall protect the insert from contamination until a workstation or patch cord is "plugged" into the outlet.
4. Copper wire outlet connectors shall be color coded to distinguish telephone/voice separately from computer/data. The outlet cover plate shall be engraved to identify telephone/voice, computer/data and other infrastructure outlets separately.
5. Copper wire outlet connectors shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements, ANSI/TIA/EIA-568C including related Standards, Amendments and TSB.
6. Copper wire outlet connectors shall be the product of the same Manufacturer.

B. Universal Outlet Connector (for twisted pair Copper Wire Premise/Workstation Wiring and copper wire patch panels).

1. General

   a. Connections for twisted pairs copper conductors shall provide a universal outlet connector between the building premise copper wire, and plug-in workstation locations. Patch panel/ equipment plug-in connectors. The connector components shall assemble with "snap-in" spring loaded retainers to prevent dislocation during insertion or removal of external plug-in devices.
   b. The contacts shall be gold plated with a 250 insertion/withdrawal cycle rating.
   c. Unless specifically noted otherwise the universal outlet connector shall comply with ANSI/TIA/ EIA-568C; related Standards, Amendments and TSB.

d. Operational characteristics shall match or exceed and shall be compatible with the respective twisted pair's cable.
e. A metal ground shield with EMI/RFI metal ground clip shall be provided where shielded cable is connected to the universal outlet connector for each universal outlet connector assembly.
f. Each universal outlet connector shall consist of three major components.

1) Universal edge connector assembly.
2) Plug-in adapter inserts.
3) Connector housing.

g. Provide snap-in blank removable insert covers for connector installed without plug-in adapter inserts.

2. Universal edge connector:

a. Insulated assembly shall connect to the premise copper wire. The connectors shall be multiple plug type connector contacts, one contact (total of eight contacts) for each individual premise wire connection interconnected to the individual wire terminations.
b. Connector shall provide insertion of individual insulated copper wire, gas tight, 110-style punch down/displacement termination, for 22-26 AWG insulated premise wire.
c. The edge connector assembly shall provide termination of eight separate wire conductors, twisted or untwisted pairs, solid or stranded, shielded or unshielded, with color codes and numbered identification of each contact. Integral cable/conductor strain relief to prevent pullout of terminated premise wire conductors.

3. Plug-in adapter inserts:

a. Plug-in adapter inserts shall be internally factory connected to the universal edge connector assembly to adapt the universal connector to the specific outlet type configuration (i.e. "RJ" style computer/data, telephone/voice, (multimedia) modular jacks, etc.).
b. Inserts shall be certified for shielded or unshielded wire, to match premise wire type connected to the universal edge connector.
c. Inserts shall provide correct pin-to-pin connections, electrical and mechanical matching characteristics for the specific equipment connected to the respective outlet.
d. Inserts for different infrastructures shall be color coded with different colors from each other, for system identifications.
e. Plug-in adapter insert type:

1) Computer/data network systems:

a) ANSI/TIA/EIA-568C, female modular jack 8-position/contact "RJ-45" style.

2) Telephone/intercom voice systems:

a) ANSI/TIA/EIA-568C female modular jack 8-position/contact RJ-45" style.

3) Multimedia audio/video TV (baseband only):

a) ANSI/TIA/EIA-568C female modular jack 8-position/contact RJ-45 style.
b) Each multimedia audio/video outlet location provides a Balun to match the circuit impedance of the premise wiring to the multimedia outlet signal type.

4) Intrusion detection/access control systems:

a) ANSI/TIA/EIA-568C female modular jack 8-position/contact RJ-45 style.
b) Each intrusion detection system outlet location provides a Balun to match the circuit impedance of the premise wiring to the intrusion system outlet signal type.

4. Connector housing:

a. Connector housing shall contain the universal edge connector assembly and the plug-in adapter inserts in a rigid assembly. Connector housing shall provide integral cable strain relief for the premise wiring connection.
b. The connector housing shall mount to a metal panel, metal device cover plate or plastic device cover plate with spring loaded snap-in retainers. Nominal depth of connector housing behind the mounting panel and/or device cover plate shall not exceed 1.625-inch including Premise Wiring Termination Depth Requirements.

C. Coaxial Cable Connectors

1. General

a. BNC type connectors, for coaxial cable premise/workstation wiring and coaxial cable patch panel equipment.
b. Unless noted otherwise, the BNC connectors shall comply with ANSI/TIA/EIA-568C and related Standards, Addendums and TSB.
c. Brass body and male contact. Beryllium copper or bronze female contact. Bayonet coupling with threaded or cam-locking mating connection.

2. Operational characteristics shall match or exceed and shall be compatible with the respective coaxial cable. 75-OHM, operational frequency range 0-4500MHz.

2.6 FIBER OPTIC FIBER DISTRIBUTION ENCLOSURES

A. General

1. Fiber optic fiber distribution enclosures shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements, ANSI/TIA/EIA–568C including related Standards, Amendments and TSB.
2. Fiber optic fiber distribution enclosures shall be the product of the same Manufacturer.

B. Equipment Rack Mount Fiber Optic Termination Distribution Enclosure - RTDE

1. The RTDE enclosure shall mount in an EIA standard 19-inch wide enclosed or open frame equipment rack assembly. The RTDE enclosure shall be metal, painted finish, Manufacturers standard color.
2. The RTDE shall provide the following self-contained functions internal to the RTDE assembly.

a. Fiber cable termination.
b. Fiber cable "pig-tail" splicing.
c. Fiber cable patch panel.
d. Fiber cable management, training and strain relief.
e. Individual fiber and patching port identification numbers, color-coding of incoming trunk and out-going distribution fiber ports.
f. Plug-in fiber optic interconnection couplers for port to port patching with portable fiber optic patch cords.

3. Fiber splice drawers:

   a. Horizontal sliding metal drawers adjustable to approximately 30-degree angle when fully open, and removable for easy access. Each drawer shall contain two fiber optic splice trays with tray holders.
   b. Drawers shall stack vertically one above the other in the RTDE and allow sufficient slack in all fiber cables for removal of the drawer and splice trays.
   c. Provide one sliding drawer and two splice tray assemblies for each group (twenty-four individual fibers or fewer fibers per group) of fiber optic fibers terminated in the equipment rack, but in no case provide not fewer than two sliding drawers with splice tray assemblies in each RTDE.

4. Fiber cable patch panel

   a. Metal panel shall provide a patch port for each fiber consisting of metal panel mounted fiber optic interconnection couplers for each fiber optic fiber indicated to be terminated at the RTDE.
   b. The fiber optic fiber interconnection coupler shall be provided to match and be compatible with the fiber cable connectors. Quantity shall match quantity of terminated fibers, unless indicated otherwise on the equipment rack schedules.
   c. Nominal panel thickness 0.09 inches.
   d. Provide a minimum of sixteen unused spaces for additional couplers in the patch panel.

5. Nominal height of the RTDE shall not be exceeded, as follows:

Quantity of Patch Ports	Quantity of Splice Drawers	Nominal Height
24	2	11-inches
48	2	11-inches
72	3	14-inches
144	6	28-inches

C. Equipment Rack Mount Fiber Optic, Splice only (for use only where fiber patch panel is not required) enclosure - RMSE

1. The RMSE enclosure shall mount in an EIA standard 19 inch wide enclosed or open frame rack assembly. The enclosure shall be metal, painted finish, Manufacturer's standard color.
2. The RMSE shall provide the following self-contained functions internal to the RMSE assembly:

   a. Fiber cable splicing for "thru splicing" of fiber optic cables where the cables do not terminate in the equipment rack.
   b. Fiber cable management, training and strain relief.

3. Fiber splice drawers

   a. Horizontal sliding metal drawers adjustable to approximately 30-degree angle when fully open and removable for easy access. Each drawer shall contain two fiber optic splice trays with splice tray holders.
   b. Drawers shall stack vertically one above the other in the RMSE and allow sufficient slack in all fiber cables for removal of the drawers and splice trays.
   c. Provide one sliding drawer and two fiber optic splice tray assemblies for each group (24-individual fibers or fewer fibers per group) for fibers optic fiber routed through but not terminated in the equipment rack, but in any condition provide not fewer than two sliding drawers with splice tray assemblies in each RMSE.

4. Nominal height of the RMSE shall not be exceeded, as follows:

Quantity of Thru Splices	Quantity of Splice Drawers	Nominal Height
24	2	4-inches
48	2	4-inches
72	4	8-inches
96	4	8-inches

2.7 COPPER WIRE PATCH PANELS

A. General

1. Copper wire patch panels shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements, ANSI/TIA/EIA-568C including related Standards, Amendments and TSB.
2. Copper wire patch panels shall be the product of the same Manufacturer.

B. Equipment Rack Mounted Patch Panel

1. Standard EIA 19-inch wide metal panel, Manufacturers standard color. Prepunched for copper wire outlet connectors. Panel shall mount on an EIA standard 19 inch wide enclosed or open frame equipment rack assembly. Nominal 24-copper wire outlet connectors in a horizontal row, quantity of rows as required for total quantity of connectors. Provide not less than two spare empty rows for future copper wire outlet connectors.

2. The patch panel shall provide the following self-contained functions.

   a. Copper wire cable termination including conductor/ shield termination and strain relief.
   b. Plug-in copper wire outlet connectors for port to port patching with copper wire portable patch cords.

3. Patch panel height shall be based on the quantity of copper wire outlet connectors described plus the specified space for future outlets and shall not exceed the following dimension height:

Outlet Quantity	Nominal Patch Panel Height
1-24	3.5 inches
25-48	7 inches
49-72	10.5 inches
73-96	14 inches

4. Horizontally mounted, cable support metal bracket shall be provided for each 24-outlet/connector groupings. The brackets shall be bolted to the equipment rack located at the backside of the patch panel; the brackets shall support and provide strain relief for each incoming copper wire cable connecting to the patch panel.
5. The copper wire connector installed in the patch panel shall be the same configuration, Manufacturer and type as the corresponding copper wire connector provided in the remote workstation outlet locations connecting to the respective patch panel outlet, unless indicated otherwise.
6. Each multimedia, audio/video/TV multimedia and intrusion detection/access control outlet. Provide a Balun, to match the circuit impedance of the premise wiring and to the outlet signal type.

2.8 TELEPHONE/VOICE TERMINAL BLOCKS

A. General

1. Terminal blocks Type 110, shall consist of wiring blocks, connecting blocks, direct wire/patch cord cross connection and designation strips. Arrange in unitized, modular, vertical mounting sections, for telephone/voice.
2. Completely 100% front accessible for cross connections, terminating conductors, training, and fanning of cables. Rear access for any reason shall not be permitted.
3. Telephone/voice terminal blocks shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements. Telephone terminal blocks and connections performance shall comply with ANSI/TIA/EIA-568C and related Standards, Addendums and TSB and shall comply with and be listed under UL 1863. Category rating shall match the cables connecting to the patch panel.
4. The telephone/voice terminal blocks shall provide cross connection of telephone/voice four pair premise copper wiring from telephone/voice handset outlets to multiple copper wire telephone/voice feeder cables and external free standing telephone equipment.
5. Each full height vertical section terminal block assembly shall terminate a minimum of 900 pairs (including specified spares for future construction phases) of telephone/voice conductors, plus associated cross connection wiring and patch cords in a nominal 20-inches wide by 90-inches high space. Provide multiple vertical sections of terminal block assemblies adjacent to each other, total quantity as required for quantity of telephone/voice conductor pairs and telephone/voice feeder cable pairs shown on the Drawings and Requirements, plus specified spares.
6. Each telephone/voice terminal block vertical section assembly shall provide 15% or 100 (whichever is the larger quantity) of spare unused conductor pair terminals for future telephone/voice connections.
7. Provide a common ground bus in each terminal block section with a minimum of six ground conductor termination positions, #10AWG through #6AWG.
8. Terminal blocks shall be the product of the same Manufacturer.

B. Wiring Blocks

1. One piece molded, die-electric thermoplastic blocks. The wiring block shall support and secure all the components of the terminal block assembly, and provide cable/conductor training and organization.
2. Fire retardant complying with UL 94V-0.
3. Standoff type support legs for mounting to backboard with pre-drilled anchor holes.
4. Non-conductive electrically quiet front assembly.
5. Horizontal index strip rows, for termination of not less than 25-conductor pairs on each row. Color coded and marked in groups of four pairs or five pairs to match connecting cables.
6. Removable retainers at the ends of each horizontal connecting block index strip row, shall support cross connect wires at corner turns.
7. Distribution rings shall retain cross connect wire horizontal routing between terminations.
8. A full width, horizontal trough between each 100 pair wiring block shall provide a path for patch cord training and retention.

C. Connecting Blocks

1. Connecting blocks shall provide gas tight conductor electrical connections with conductor insulation displacement punch down slots, for insertion onto the telephone/voice wiring block index strips.
2. Connecting blocks shall electrically connect one-to-one between each conductor terminated at the wiring block index strips, and each cross connect/patch cord conductor terminated/connected to the opposite front side of the connecting block.

3. Both sides of the connecting blocks shall terminate telephone/voice UTP 22-26AWG stranded or solid copper wire individually insulated conductors. The front side of the connecting blocks shall also provide "plug-in" connections for portable patch cords, 110 style "plug-in" connectors.
4. Connection blocks shall be 4-pair insulated copper conductor type.
5. Provide insulated, removable termination caps for each connector block.
6. Connector blocks shall be marked to indicate tip and ring conductors and to indicate polarization.

D. Designation Strips

1. Designation strips shall provide retention of interchangeable labels. The labels shall show circuit identification of each terminated conductor pair.
2. The designation strips shall mount on the center and outside positions of the wiring block.

E. Telephone/Voice Cross Connection

1. The cross circuit connection between incoming and outgoing feeder cables and telephone voice outlet wiring shall be provided in the terminal block assembly.
2. The cross connection wiring shall terminate incoming and outgoing circuit conductors between respective connecting blocks.

    a. Direct connect cross connection shall provide internally wired one-to-one conductor twisted pair cross connection. Provide cross connection of each 4-pair telephone/voice outlet cable to corresponding 4-pairs of the telephone/voice feeder cable and cross connection of feeder to feeder cables, as applicable.
    b. Patch panel cross connect, 110-terminal connector style, plug-in. Provide two twisted pair, 110-connector type portable patch cords.
    c. Prewired 50 pin-amphenol connectors:

        1) Provide factory prewired 50-pin amphenol connectors for connection from telephone/ voice terminal blocks to the telephone switch equipment and Telephone Utility Company outside telephone service lines.
        2) Provide 50-pair ANSI/TIA/EIA-568C and related Standards, Addendums and TSB cables, connected to 50-pin amphenol connectors at one end (telephone equipment connection) and connected to the respective telephone/voice terminal wiring blocks at the other end.
        3) The 50 pin amphenol connectors shall group together and be positioned at the top of the respective terminal block section near the ceiling.
        4) The pin-to-pin conductor assignments shall conform to the Telephone Switch Manufacturer's Requirements.
        5) The amphenol connector/cable assemblies shall connect to and extend the telephone/ voice outlet premise wiring from telephone/ voice terminal block to the telephone switch equipment. The amphenol connector/cable assembly shall connect to and extend the Telephone Utility Company outside telephone service lines to the telephone switch equipment.

    d. Prewired "RJ" style modular jacks

        1) Provide factory prewired eight position/contact plug-in "RJ" style jacks for patch panel portable patch cord cross connects, located on the front side of the terminal blocks.
        2) The pin-to-pin conductor assignments shall conform to the Telephone Switch Manufacturer's Requirements.

2.9 EQUIPMENT RACK

A. General

1. An equipment grounding bus, nominal 19-inches long, UL labeled as a ground terminal bus, shall be provided on each equipment rack. The ground bus shall be bolted to the rack main metal frame member with 1-inch standoff non-insulating bolts. Provide a minimum of ten drilled and taped bolt holes in the ground bus with ground lug bolts, for connection of equipment grounding conductors to the ground bus, size to accept ground conductors #14-#4AWG.
2. Vertically mounted, cable management metal rings (aluminum or stainless steel) shall be provided full height, continuously along the front and rear of each vertical rail of the equipment rack. The rings shall be bolted to the equipment rack. The rings shall train and dress portable patch cords connecting between outlet connectors located in the equipment rack or in adjacent equipment racks.
3. Provide horizontal cable management panels with multiple cable training rings on each panel (not less than five rings for each panel). Management panels (for up to 24-outlet grouping) nominal 19-inches wide by 1.75-inches high by 3-inches deep and/or (for up to 48-outlet groupings) 3.5-inches high by 3 inches deep, for EIA rack installation. Rings shall provide horizontal routing and support by grouping portable patch cords connecting between patch ports in the same equipment rack or adjacent racks. Patch cords shall be grouped and bundled with “Velcro” tie wraps and shall not overlap patch fields or rack mounted equipment. The cable management panels shall be installed on both the front and rear of the equipment racks mounted both above and below horizontally between groups of patch ports as follows:

    a. One cable management panel (front and rear of rack) for each group of forty-eight or less copper wire outlets for patch ports.
    b. One cable management panel (front and rear of rack) for each group of 48-fiber optic outlet patch ports.

4. The entire rack assembly including any support arms shall comply with Seismic Earthquake Requirements for install location structural standards.

    a. The assembly shall provide support for the weight of the equipment installed on the rack, but in no case less than 500-pounds of equipment, plus the weight of the rack and connecting cables. A 2.0 time’s safety factor shall be included in the equipment rack assembly structural design.

5. Provide Plug Strip Surge Protection Device with RF Suppresser (SPD) and Power Distribution Units (PDU). Horizontal strip, mounted in each equipment rack. Each unit shall contain not less than six “plug-in” on the rear of the SPD and not less than two plug-in on the front of the SPD protected outlet plugs.

    a. Provide two SPD/PDU units in each equipment rack, to supply “dual-corded” equipment.

6. Provide pre-drilled mounting holes the entire length of equipment vertical mounting frames, EIA-310D-19 inch (nominal) wide standard spacing for indicated equipment. Racks shall provide 17.75-inches (nominal) equipment horizontal mounting space between vertical rails.
7. Provide all floor standing equipment racks with wall bracket support arms extending from the stationary portion of the rack to adjacent wall. Provide "dual-rail arm" cable “runway tray”, horizontally from each equipment rack, to the wall directly behind the equipment rack

    a. The tray shall extend from and bolt to the top of the equipment rack “fixed” top rail.
    b. The tray side rail arms shall be a minimum of 6-inches deep, with "ladder" type rungs spanning horizontally between the side rail arms. The rail arms shall be parallel with each other. The rail-to-rail arm spacing shall be the same as the equipment rack width.

c. The rungs shall be spaced not more than 6-inches on center between the side rails, along the length of the side rail arms. The rungs shall have a minimum cable-bearing surface of not less than 0.75-inches, lengthwise along the tray.
d. The runway tray shall support a minimum of 200 pounds per linear foot live conductor/cable loading, with not more than 0.25-inches deflection at mid-span.
e. Provide a continuous horizontal support "C" channel along the wall behind the equipment racks and bolt the dual-rail arm cable runway tray to the channel at the wall. The channel elevation on the wall above the finish floor shall support the runway tray horizontally (± 0.2-inches), from the equipment rack to the wall.
f. Equipment racks shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements, ANSI/TIA/EIA-568C including related Standards, Amendments and TSB.
g. The wall mounted horizontal support channel shall be securely through bolt to wall structural member, a minimum of 16-inches on center. The horizontal support channel shall extend a minimum of 6-inches past each side of the runway tray. Support channels as manufactured by Unistrut-P1001C Series; or B-Line; or Kindorf.

8. Provide a copper ground – bus for equipment bonding, in each equipment rack.
9. Equipment racks shall be Manufacturer's standard rust inhibitor primer. Manufacturer's standard color finish paint over primer, unless noted otherwise.

B. Swing Gate Open Equipment Rack Style:

1. Combination wall and floor mounted rack frame nominal 78-inches of usable equipment vertical space for mounting equipment into the rack. The equipment mounting portion of the rack shall be a hinged gate frame assembly. The rack shall provide access to the rear of the installed equipment, the wall behind the rack assembly and wall mounted terminal blocks, when hinged open.
2. The gate assembly shall hinge open not less than 90 degrees from the closed (normal position) on a fixed frame combination floor/wall mounted support structure. A positive latching mechanism shall lock the gate in the fully open and fully closed positions. The rack construction shall allow opening the swing gate, with the installed equipment depth, without obstruction. The fixed stationary portion of the swing gate rack assembly shall be supported from both the fixed floor bracket and wall located behind the rack with adjustable length "dual rail arm" wall brackets. The arms shall provide field adjustment (approximately 24-inches) of the equipment rack spacing from the wall behind the rack. Provide a minimum of two support arms for each swing gate equipment rack.
3. The rack assembly shall be constructed of extruded metal; aluminum gold irradiates finish, or hot dip galvanized steel. Bolted or welded assembly. Hardware shall be stainless steel.
4. Provide steel caster rolling wheel support on the bottom rail of the moveable swing gate frame. The wheel shall provide additional support, but not the main support, of the moving gate assembly and rack mounted equipment along the floor travel "outside arc" of the gate in the open or closed position. The vertical height of the wheel assembly shall be adjustable ±3 inches.
5. Swing gate equipment racks as manufactured by B-Line; or Saunders; or Hendry.

C. Floor Standing Equipment Rack Fully Metal Enclosed Style:

1. Floor mounted self-supporting rack, nominal 80-inches high by 24-inches deep, by 24-inches wide. Internal bolted or welded hot dip galvanized steel or gold irradiate finish aluminum, support frame. Metal enclosed with screw attached removable metal panels. Manufacturer's standard finish color.
2. The front and rear of the rack shall be a full height hinged door, opening not less than 90 degrees from the closed position. The doors shall be readily removable with positive latching mechanism to lock to the doors in fully open or fully closed positions. Doors shall be pad-lockable. Rack shall provide a minimum of 4-inches of clear space between front door and internal mounting face for rack mounted

equipment. Smoke/grey impact resistant, tamper resistant see-through windows in the doors, front and rear. Hardware shall be stainless steel.

3. Provide six 120-volt 60Hz AC motor direct drive air ventilation, "muffin" style, nominal 4-inches square, exhaust air fans. Flush mount fans in the top of each equipment rack. The fans shall be low speed, low noise type with wire guards to prevent accidental contact with the fan blades. The fan motor shall be high impedance, self-protecting type motors. Provide "SO" cord with plug caps to connect from the fans to the 120 volt plug-strip in the equipment rack.
4. Provide cooling air intake louver with a removable 19-inches wide air filter and air filter holder, mounted in the bottom of the rack front nominal 6-inches high.
5. Floor standing metal enclosed equipment racks as manufactured by Stantron; or BUD; or equal.

D. Fixed Position Floor Standing Open Frame Equipment Racks:

1. Floor mounted self-supporting rack, nominal 78-inches of usable mounting frame height for equipment.
2. Bolted or welded hot dip galvanized steel or gold irradiate finish aluminum support frame. Hardware shall be stainless steel.
3. Open frame rack construction, fixed, non-swing gate.

    a. “Two-post” style for equipment racks not designated as containing UPS equipment nor server equipment.
    b. “Four-post” style for equipment racks designated as containing UPS equipment and/or server equipment.

4. Open frame equipment racks as manufactured by B-Line; or Saunders; or Hendry.

E. Floor Standing Modular Frame Equipment Racks

1. Provide a modular frame equipment rack, bolt together modular rack system with all accessories for a completely assembled equipment rack unit. The rack system, when configured for specific equipment, shall support and organize network servers, keyboards, printers, tape drive units, RAID units, CRT's, UPS units, telephone switching equipment, desk top work spaces, etc.
2. Nominal overall dimensions 31-inches deep by 72-inches wide by 84-inches high. Left/right or right/left orientation as indicated on Drawings. Minimum weight capacity of the entire rack assembly shall be 1500 pounds.
3. Manufacturer's standard finish painting, crème white color for metal surfaces. Horizontal flat support surfaces shall be post-formed, laminate top finish, white color.
4. "8L-01/8L-02" vertical support upright assemblies; shall be slotted the full height to "hook-on", lock in and support adjustable height (in 1-inch increments), modular components, with integral floor support "feet". Open back frame - "LF31". Minimum of three vertical support and open back frames in each complete assembly.
5. Provide vertical (on upright supports) and horizontal (on modular "hook-on" components) wire management raceways integral to the assembly.
6. Network server configuration - equipment rack unit:

    a. "LE28" computer tower "roll-out" horizontal floor shelf; nominal 47-inches wide by 24-inches deep. Shelf shall pull out on "ball-bearing" rails, with 23-inch extension for access to computers. Provide one tower shelf for rack unit. Minimum weight capacity 750 pounds. Mount at floor.
    b. "LE25"-computer tower horizontal shelf with ±12 inch end panels and two shelf support brackets; nominal 47-inches wide by 22-inches deep, fixed mounted. Provide one tower shelf for rack unit. Minimum weight capacity 500 pounds. Mounting height ±30-inches.

c. "LB32" horizontal work surface; nominal 24-inches wide by 27-inches deep. Provide one work surface assembly for each rack unit. Minimum weight capacity 300 pounds. Install on left or right side of rack as shown on Drawings. Mounting height ±28-inches.
d. LF10/LF11/W162 - General equipment shelf; nominal 72-inches wide by 15-inches high by 16.7 inches deep, with two horizontal shelf surfaces, full width of rack, ± 10-inches nominal vertical height between shelves and five vertical shelf dividers. Minimum weight capacity 300 pounds. Provide one general equipment shelf assembly for each rack unit. Mount at top of rack.
e. "LA-09" - Keyboard platform. Retractable keyboard platform with auxiliary mouse pad and up-down 15 degree adjustable tilt and adjustable 360 degree swivel. Nominal 23-inches wide by 11 inches deep. Provide three keyboard platforms for each rack unit. Install below, upper tower computer shelf and work surface.

F. Plug Strip Surge Protection Device (SPD).

1. General

a. Self-contained unit combining plug-in receptacle strip and SPD. Rated 20-amp, nominal 120-volt +10%, 60Hz, AC, 2400 watts full continuous load. Internal 20-amp resettable overload protection circuit breaker. Red illuminated on-off switch. 9-foot, 12AWG three-conductor grounded, high abuse heavy duty jacketed AC, line cord with NEMA 5-20P cap.
b. Multi-outlet receptacles, suitable for use with the following types of plug in loads; data processing equipment, audio/video equipment, test instruments, medical equipment, photo graphic equipment and “switching type” power supplies.
c. Protected 120-volt outlets shall be NEMA 5-15R 15-amp, or 20-amp NEMA 5-20R AC 60Hz receptacles, as applicable for connected equipment loads. Provide not less than eight protected outlet plugs on each unit. Each individual or group of two receptacles (duplex) shall be connected to separate protected load isolated filter banks.
d. Each duplex shall be isolated from the other output receptacles, minimum isolation of 25dB at 1MHz line to line, line to neutral, line to ground and neutral to ground.
e. Non-blocking plug-in locations/orientation, for plug-in self-contained “power-brick”, equipment power supplies.
f. As manufactured by Liebert; or TRIPP LITE.

2. Operation

Self-contained RFI and EMF shielded housing with mounting slots for temporary mounting of the unit. Protected outlet receptacles shall supply over current protected and filtered, electrical line voltage power to the connected equipment. Line noise RFI and EMI interference filtering suppression, surge protection device and spike protection shall occur in all three modes of operation line to ground, line to neutral and neutral to ground rated as follows:

a. 13,000 amp, 210 joules (watt-seconds) peak withstands capacity.
b. Surge response time less than 5-nano seconds.
c. 140-volt AC RMS initiate spikes suppression 330 volt maximum let through.
d. RFI and EMI Suppression-Provide spectrum analysis test dB attenuation reports showing RFI filtering over specified frequencies.
e. Diagnostic indicator lights located on the SPD housing shall provide alarm alert for each of the following conditions:

1) Loss of AC power.
2) Damage, malfunction in the SPD circuits.
3) Improper AC electrical outlet wiring.

f. Standards Testing, Listing and Certification Compliance:

1) IEEE 587 A and B compliance.
2) UL 1449 surge suppressers.
3) UL 1363 temporary power taps.
4) UL 1283 electromagnetic interference filters.

3. Rack Mounted SPD

a. SPD units installed in equipment racks shall comply with all of the same Performance Requirements including as follows.

1) EIA/TIA – Equipment rack horizontal mount style (19-inches or 24-inches as applicable).
2) Minimum of two front mounted outlets and not less than six rear mounted outlets.
3) Position in each equipment rack as directed by Owner's Representative.
4) Provide two SPD units in each equipment rack, for "dual-corded" network equipment.

G. Power Distribution Unit (PDU)

1. General

a. Self-contained unit combining main circuit breaker, multiple plug-in individual circuit breaker branch protection load receptacles, PDU metering status monitoring and network communication. All PDU components self-contained in a NEMA-1 metal enclosure.
b. Non-blocking plug-in locations oriented for plug-in self-contained "power-brick" equipment supplies.
c. Standards Testing

1) UL 60950-1 Information Technology Equipment.
2) CAN/CSA-C22.2 No.60950-1-03 Information Technology Equipment.
3) FCC, Title 47, Part 15 Subpart B for Class B operation as defined by ANSI Standard C63.4.
4) ROHS Complaint.
5) ISTA Procedure 1A and 2A.

d. Provide two PDU units in each equipment rack, to supply two SPD units in each equipment rack.
e. Shall be a product of the same Manufacturer as the SPD unit. As manufactured by Liebert; or TRIPP LITE.

2. System Description

a. Remote monitoring and/or control capabilities for power distribution at each load/equipment rack level. For data/network equipment line voltage plug-in and SPD line voltage plug-in electrical distribution.
b. PDU shall meter and monitor electrical attributes of an individual Rack PDU, including real-time remote and local display of monitoring of aggregate and branch electrical parameters (status, thresholds, alarms) including voltage, ampere, and kW. Rack equipment PDU and Branch load monitoring and control.
c. Self-contained metering and communications

1) Local display ampere-meter demand load meter to monitor plug-in demand load and total PDU load.

2) Digital Fast Ethernet LAN RJ-45 communications port for Ethernet SNMP and IP network monitoring of electrical status. Multi-user site-wide software license, compatible with PC-computer and IP-WEB HTTP protocols.
3) Provide network array-interface for connection of multiple PDU units positioned in the same location.

d. Nine foot input power (heavy duty high abuse) cord with appropriate conductors and input NEMA plug-in connection. Provide input overload protection with Hydraulic-Magnetic main input circuit breaker. Provide load output NEMA plug-in branch connection with overload circuit breaker protection for each load receptacle.
e. Equipment rack mounting horizontal position form factor.

3. Electrical Power ratings shall be as follows and as additionally indicated on Drawings. Refer to Drawings for twist-lock verses straight-blade configurations.

a. Single main input circuit breaker 30 amp, 208/120 volt 3-phase 5-wire "WYE" grounded 60Hz AC.
b. Branch load circuit breakers with a single plug-in receptacles for each load circuit breaker. Balance loads on each circuit phase.

1) Three 20 amp 1-pole circuit breaker and three NEMA 5-20R receptacles. Also provide matching caps.
2) One 30-amp 2-pole circuit breaker and one NEMA 14-30R receptacle. Also provide matching cap.
3) Additional circuits and receptacles as indicated on Drawings.

4. Provide heavy duty high abuse flexible copper wire 300-volt insolated 15-feet long jacketed electrical cord. Connect from PDU to wall-outlet receptacle with same electrical rating as PDU. Rated for PDU voltages and amperes.
5. PDU units installed in equipment racks shall comply with all of the same Performance Requirements including:

a. EIA/TIA – equipment rack horizontal mount style (19-inches or 24-inches) as applicable.
b. Position in each equipment rack as directed by Owner's Representative.

6. Provide two Category-6A 4-pair UTP 15-foot long portable patch cable connects, PDU to respective network patch panel port.

2.10 WALL MOUNT FIBER OPTIC CABLE INTERFACE CABINET (WMIC)

A. General

1. Metal (14 gauge) enclosure, with full height hinged metal door. Door shall be pad-lockable. Nominal size 12-inches deep by 18-inches wide by 36-inches high. Enclosure shall mount directly on the wall.
2. WMIC shall be UL listed, complying with National Electrical Code, ETL Tested and Certified to comply with or exceed Specified Requirements, ANSI/TIA/EIA-568C including related Standards, Amendments and TSB.
3. Interface cabinets shall be the product of the same Manufacturer.

B. The WMIC shall provide the following self-contained functions internal to the WMIC enclosure.

1. Fiber cable splicing for "through splicing" of non-UL listed fiber optic cables, where the cables do not terminate in the building.
2. Fiber cable management, training and strain relief.
3. Transition from non-UL flame spread listed fiber optic cable, to UL flame spread listed fiber optic cables where the cables terminate in the building.

C. Cable routing rings shall organize optic fibers in a 360 degree loop inside the WMIC housing and provide cable strain relief.

D. Fiber Optic Splice Trays

1. Provide fiber optic cable splice trays.
2. Tray holders shall provide mounting and support for each splice tray.
3. Provide two splice trays for each group (24 or less fibers per group) fiber optic fibers routed through the WMIC, but in no case provide not less than four splice trays in the WMIC.

2.11 UNIVERSAL SPLICE ENCLOSURES - USE

A. General

1. The universal splice enclosure shall provide splicing for multiple cables containing multiple, network copper wire conductors or fiber optic fibers.
2. The enclosure with the connecting cables installed shall be water tight, continuously submersible in up to 10-feet depth of water without leaking water into the enclosure interior.
3. The enclosure with splices shall be completely re-enterable to allow access to the interior splices, adding cables, and removing cables, without compromising the water tight integrity of the enclosure.
4. The universal splice enclosure assembly shall be UL listed.
5. The USE shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements, ANSI/TIA/EIA-568C including related Standards, Amendments and TSB.
6. USE shall be the product of the same Manufacturer.

B. Fiber Optic Splices

1. Provide fiber optic splice trays inside the USE. Each splice tray shall provide space for up to 12 splices in lieu of 24-splices on the tray.
2. A splice tray holder shall rigidly anchor splice trays inside the USE, with sufficient slack cable, to allow individual removal of each splice tray.
3. Provide one splice tray for each 12-fibers passing through the USE, but not less than eight splice trays in the use enclosure.

C. Copper Wire Splices

2.12 SPLICE TRAY FIBER OPTIC FIBERS

A. General

1. Trays shall be suitable for installation in USE, WMIC, RMSE and RTDE enclosures.
2. The trays shall be the product of the same Manufacturer as the respective enclosures.

3. Splice trays shall be UL listed, complying with national Electrical Code, ETL tested and certified to comply with or exceed specified Requirements, ANSI/ TIA/EIA-568C including related Standards, Amendments and TSB.

B. Splice Trays

1. A metal or non-metal splice tray shall provide space for up to 24-splices of individual fiber cable single mode and multimode optical fibers. The trays shall provide individual splice holder inserts for each splice to adapt the tray for mechanical or fusion splices, with or without splice sleeves.
2. The tray shall incorporate integral fiber tie down clamps, fiber routing rings, provide strain relief and two full 360-degree fiber loops around the tray perimeter with sufficient slack fiber for removal of the tray for access and splicing of the fiber cable. The tray shall insure the minimum bending radius of the optical fibers is not violated.
3. Provide a removable clear plastic tray top cover for each tray, to protect and isolate the fibers.

2.13 WORK STATION OUTLETS

A. General

1. Engrave outlet cover plates with the port number corresponding to the port number at the respective terminal block, patch panel, or head-end equipment.
2. The outlet cover plates shall be factory pre-punched and formed to accommodate the installed outlet connector with attachment screws.
3. Workstation outlets shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements, ANSI/TIA/EIA-568C including related Standards, Amendments and TSB.
4. Workstation outlets shall be the product of the same Manufacturer.

B. Computer/Data Workstation Copper wire Outlets

1. The outlets shall be the same configuration and type as the corresponding connector provided in the copper wire patch panel outlet, unless noted otherwise.
2. ANSI/TIA/EIA-568C, and related Standards, Addendums and TSB.
3. The copper wire outlet connectors for twisted pair wire connections in computer workstation outlets shall be universal outlet connector RJ-45 type.

C. Telephone/Voice Handset Twisted Pair Wire Connection Work Station Outlets

1. The copper wire outlet connectors provided in telephone/voice handset outlets, shall be universal outlet connector type, unless noted otherwise, ANSI/ TIA/EIA-568C and related Standards, Addendums and TSB.

   a. RJ-45 type
   b. RJ-11 type

D. Fiber Optic Workstation Outlets

1. The fiber optic outlet connectors workstation outlets shall be fiber optic fiber interconnection couplers, installed in universal outlet connectors. Provide one coupler for each fiber connecting to the outlet, but in no case less than the following for each outlet and as shown on the Drawing:

    a. Computer workstation data network two couplers and fiber connectors.
    b. Data network server - four couplers and fiber connectors.

2. The universal outlet connector housing and cover plates shall be the same as copper wire outlet connectors, except with adapters for fiber optic interconnection couplers, for the fiber optic fibers plug-in connectors.
3. The centerline-to-centerline spacing of the inter-connection couplers shall provide for "plug-in" insertion of “single or duplex” fiber connectors.
4. Color-code and identify the "in"-receiving and "out"-transmitting position for each interconnection coupler.

E. Outlet Boxes

1. General for Low Voltage Outlets Requirements

    a. Shall be UL approved and labeled for Life-Safety Appliances.
    b. UL listed and label for low voltage CEC/NEC class-2 wiring and devices.
    c. Shall be adjustable to fit into the wall/ceiling and attach into the wall/ceiling thickness at each install location.
    d. Provide cable “Strain-Relief” attachment and “Sharp-Edge” protection for each outlet cable connections.

2. Wall mounted

    a. Flush or surface wall mounted outlet box and size as indicated on the Drawings, but in no case less than 4.69-inches by 4.69-inches by 2.125-inches deep.
    b. Two gang wide extension ring for outlet box to extend outlet flush with finish surface, or as noted on the Drawings.
    c. Two gang wide cover plate, or as noted on the Drawings.

3. Pedestal Mounted "Poke-Thru".

    a. Shall combine a computer/data and a telephone/ voice copper wire universal outlet connector in a duplex outlet in the pedestal/poke-thru outlet.

4. Inside flush floor boxes and other locations where indicated in the Contract Documents.

5. Low Voltage Outlets in Fire rated walls and ceilings

    a. Provide metal outlets for low voltage devices installed (recessed into) in fire rated walls or fire rated ceilings.
    b. Provide metal outlet box enclosed type, for each outlet location. Provide UL labeled and listed “Fire-Wrap” complete coverage protection on the exterior of each outlet box. The combined outlet box and “Fire-Wrap” protection shall be equal or greater than the respective wall or ceiling fire-rating location.

6. Low Voltage Outlets in Non-Fire Rated walls and ceilings

a. Outlets for low voltage devices installed (recessed into) walls or ceilings, only where the wall/ ceiling is not fire-rated.
b. Provide the following for each outlet location

1) Metal outlet box, enclosed type. All locations where one or more conduit(s) are required to connect to the outlet, then only metal outlet box shall be provided.
2) Or device mounting bracket with trim ring, without (backless) enclosed outlet box. Do not use bracket-trim/ring configuration where conduit connection to the outlet with conduit is required, provide metal outlet boxes. Shall provide attachment for low voltage device(s), cover plates and low voltage wire strain relief.

7. Low Voltage outlet installed into accessible suspended ceiling with removable ceiling panels.

a. Support outlet independent of ceiling supports and ceiling.
b. Provide a minimum of three independent hanger wires for each outlet. Attach hanger wires to building structure above ceiling and to outlet.

8. Low Voltage Outlets in existing walls and existing ceilings

a. Outlets installed (recessed into) existing walls or (recessed into) existing ceilings. Cut and patch to match existing surfaces for outlet installation.
b. Provide “cut-in” retrofit mounting-attachment into existing ceiling/wall construction. Shall be UL rated for retrofit into “old-work”.
c. Provide the following for each outlet location,

1) Metal outlet box, enclosed type. Required for all Fire rated construction locations. Also permitted for non-Fire rated construction locations.
2) Or device mounting bracket with trim ring. Permitted only for non-Fire rated construction locations only where no conduit connection to the outlet is required. Do not use in Fire rated construction locations. Do not use where conduit connection to out-let is required.

d. Where the existing wall/ceiling existing fire rating is indeterminate, Contractor shall assume the existing fire rating is not less than 2-hours. Provide metal outlet box and Fire-Wrap for each recessed outlet box.

F. Multi-outlet Raceway Work Station Outlets

1. Copper wire outlet:

a. Where copper wire connection is indicated for the workstation outlet, provide one universal outlet connector for each outlet.
b. Each universal outlet connector shall be single connector housing type.
c. Provide a rectangular cutout and metal device plate in the raceway sized to Outlet Manufacturer's recommendations. The workstation copper wire outlet shall mount a modular faceplate kit with outlet bezel and faceplate sized to match the workstation outlet.

d. Offset the location of outlets for electronic network systems 6-inches in the raceway from other outlets, do not "stack" outlets one above the other in the raceway.

2. Fiber optic outlet:

G. Combination Outlets

1. Infrastructure outlet connectors shown at the same location for either wall box outlet locations and floor box outlets locations.
2. The outlet connectors shall be installed in a common outlet box with a common cover plate in the respective wall location or floor location.
3. In infrastructure patch panels install the connectors in the respective patch panels.

2.14 PORTABLE PATCH CORDS

A. General

1. Provide portable patch cords for all copper wire and fiber optic cable infrastructure outlets:

   a. For interconnecting electronic network equipment to electronic network workstation outlets.
   b. For interconnecting equipment rack patch panel outlet patch locations with each other.
   c. For interconnecting patch panel outlets equipment rack mounted hubs, switches, routers, telephone equipment, A/V equipment, access control and intrusion detection equipment etc.

2. Patch cords shall be factory assembled tested and certified with factory terminated plugs at each end. Field terminated portable patch cords shall not be permitted. Terminated plugs shall incorporate integral bending radius limiting molded “boots” and strain relief. Patch cord assemblies shall be rated for "heavy duty", “high-abuse” service.
3. Patch cords shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements. ANSI/EIA/T1A-568C, related Standards, Addendums and TSB.

   a. NEC - OFNG/OFN for fiber optic portable patch cords.
   b. NEC - MPP/CMP/CMR/CMG/MPG for copper wire twisted pair portable patch cords.
   c. NEC - CATV for coaxial cable portable patch cords.

4. Patch cords which are not installed shall be delivered to the Owner in cardboard boxes. The patch cords shall be neatly bundled and tied together. Mark each box with quantity and type of cords contained in the box.
5. Patch cords shall comply with the same Cable Communication Performance Requirements, Protocol Requirements and Testing Requirements as the respective infrastructure cables and outlets to which the patch cords are intended to be connected (plug-in). Patch cords shall be the product of the same Manufacturer.
6. The outer jacket of each portable patch cord shall be imprinted with date, Manufacturer’s model and catalog number and AHJ listing identification.
7. Provide a permanent, visible, factory applied identification number on each end of each patch cord. The identification number shall be the same on each end. However, the numbers shall increase sequentially on each patch cord and shall be unique and not duplicated on other patch cords. Permanently apply the identification numbers on the cable jacket or connectors.

B. Twisted Pairs, Copper Wire Portable Patch Cords

1. Twisted Pairs portable patch cords, general:

   a. "Male" eight-position modular "RJ" male style jacks install on each end of the patch cord cable. The jack shall be provided with a rear "fin" to prevent the plug tab from snagging when pulled backwards through adjacent wiring.
      RJ-45 style “male” jack, typical unless noted otherwise.
   b. Patch cord cable shall be UTP and ANSI/EIA-Category rating, shall match respective premise wiring, 4-pair twisted, stranded copper individually insulated wires, thermoplastic jacket over all the wires and shield.
   c. Connectors shall comply with FCC 68.5 and Part 68 Subpart F.
   d. Connectors UL listed and shall comply with UL-94V-O.
   e. Contacts gold plated with not less than a 750 insertion/withdraw cycle rating.

2. Portable patch cord quantities and lengths for connecting port-to-port equipment rack patch panels

   a. Patch cord quantity: Provide one complete patch cord assembly for each copper wire equipment workstation outlet patch port in the equipment rack patch panels. One-to-one straight through pin-to-pin wiring. Provide additional spare patch cords, quantity equal to 25% of the total quantity of patch cords provided for copper wire computer workstation outlets in the equipment rack patch panels. Cable jacket color shall be blue:
   b. Provide the following lengths of copper wire patch cables for copper wire equipment rack patch panel outlets.

      1) 2-feet long - 10% of total quantity
      2) 4-feet long - 30% of total quantity
      3) 6-feet long - 30% of total quantity
      4) 10-feet long - 20% of total quantity
      5) 16-feet long - 10% of total quantity

3. Portable patch cord quantities and lengths - for connection from equipment workstations to equipment workstation outlets, located remote from equipment racks.

   a. Patch cord quantity: Provide one complete patch cord assembly for each copper wire work-station outlet located remote from the equipment rack patch panels. Provide additional spare patch cords, quantity equal to 15% of the total quantity of patch cords provided for each copper-wire computer workstation outlets. Cable jacket color shall be blue:

      1) Infrastructure network outlet segments the pin-to-pin patch cord wiring configuration and jacks shall be compatible with the equipment protocol communications interface, and the respective workstation outlet.

   b. Provide the following lengths of copper wire patch cables for equipment copper wire infrastructure network workstation outlets. The patch cords shall provide internal cross-over wiring to conform the pin-to-pin connections required between the equipment workstation outlet and the equipment protocol communications interface installed in the respective work-station equipment:

      1) 8-feet long - 30% of total quantity
      2) 15-feet long - 70% of total quantity

4. Portable patch cord quantities and lengths for connection from electronic equipment rack patch panel ports to equipment installed in equipment racks, such as HUB's, servers, switches, router, telephone and concentrator equipment ports. Cable jacket color shall be white.

    a. Patch cord quantity: Provide one complete patch cord assembly for each copper wire outlet port located in electronic equipment. Provide additional spare patch cords, quantity equal to 25% of the total quantity of the equipment rack equipment ports.

        1) The pin-to-pin patch cord wiring configuration and jacks shall be compatible with the respective equipment and patch panel outlets as applicable.

    b. Provide the following lengths of copper wire patch cables for outlet ports located in electronic equipment installed in equipment racks. The patch cords shall provide quantity of conductors, wiring shall conform the pin-to-pin connectors and jack/ connectors to the ports in the equipment mounted in the equipment racks.

        1) 4-feet long - 15% of total quantity
        2) 6-feet long - 30% of total quantity
        3) 10-feet long - 35% of total quantity
        4) 16-feet long - 20% of total quantity

5. Portable patch cord quantities and lengths for connection of equipment requiring customized pin-to-pin wiring configurations and/or customized port connector configurations. Cable jacket color shall be tan.

    a. Patch cord quantity: Provide one complete patch cord assembly for each outlet port install as part of the Contract and not identified in any other patch cord descriptions. The patch cords shall be customized and configured to comply with the respective Manufacturers recommendations.
    b. Provide one patch cord for each port-to-port connection length as required for actual installation condition.

        1) Provide 100% spare but not less than one spare patch cord for each custom configuration.

C. Telephone/Voice Copper Wire Portable Patch Cords-110 style

1. 110 style jacks for plugging into the 110 style connecting blocks located in the telephone/voice terminal blocks.
2. Patch cords shall be UTP 4-pair twisted, 24AWG stranded copper individually insulated wires with a thermoplastic jacket over all the wires. Cable shall be ANSI/TIA/EIA-568C.

3. Patch cord quantity and length - telephone/voice terminal block:

    a. Provide one complete patch cord assembly for each copper wire telephone/voice outlet connecting to the telephone/voice terminal block. Provide additional spare patch cords, quantity equal to 25% of the total quantity of patch cords provided for telephone/voice 110 patch cords.
    b. Provide the following lengths of copper wire patch cables for telephone/ voice 110 style connecting block portable patch cords.

        1) 3-feet long - 25% of total
        2) 5-feet long - 50% of total
        3) 15-feet long - 25% of total

D. Coaxial Cable Portable Patch Cords

1. BNC type connectors on each end of each patch cord. Shall be compatible with patch panel outlets, workstation outlets and respective equipment rack electronic equipment.
2. Patch cord quantity: Provide two complete patch cord assemblies for each coaxial cable outlet.

    a. One patch cord for workstation outlet located remote from the equipment rack patch panel, 15-feet long each patch cord.
    b. One patch cord for equipment rack (IDF/MDF) patch panel each outlet location, 10-feet long each patch cord.
    c. Provide 15% additional spare patch cords of each patch cord length.

E. Fiber Optic Portable Patch Cords

1. General

    a. Provide fiber optic fiber connectors installed on each fiber end of the patch cord cable. The fiber optic portable patch cord shall be “single” with one fiber strand type, for each patch cable. The connector shall be mechanically and optical compatible with the respective connecting patch panel couplers and network work equipment couplers.
    b. The entire patch cord assembly total insertion loss shall be less than 1.0dB at the specified operating wavelengths.
    c. Operating temperature range 30-degrees centigrade through +60 degrees centigrade. Cables shall be flame retarding.
    d. Each fiber shall be individually identified with factory color-coding and factory imprinted label. The outer cable jacket shall be imprinted with date, Manufacturer's model and catalog number, along with agency listing identification. The cable jacket color shall be yellow.
    e. All fiber optic patch cord cable shall be a product of the same Manufacturer.
    f. Optical fiber shall be coated, 900 micron diameter uniform coating, with uniform tight buffering over the coating, uniform dielectric strength member surrounding the buffering coating and an overall jacket around each optical fiber assembly.
    g. A dielectric strength member shall surround the fiber assemblies.
    h. An outer dielectric jacket shall envelope the entire cable.
    i. The cable shall be UL listed and comply with NEC and NFPA Requirements for each installation location shown in the Contract Documents.
    j. Patch cord quantity and length

        1) Patch cord quantity: Provide one complete patch cord assembly for each fiber optic patch panel outlet in the equipment rack.
        2) Provide one complete patch cord assembly for each computer workstation fiber optic outlet remote from the patch panel.
        3) Provide additional spare patch cords, quantity equal to 25% of the total quantity of patch cords provided.

    k. Provide the following quantities and lengths of fiber optic patch cords.

        1) 3-feet long - 20% of total
        2) 6-feet long - 35% of total
        3) 10-feet long - 30% of total
        4) 20-feet long - 15% of total

2. Multimode patch cords

a. Patch cord cable shall be fiber optic cable with equal or better characteristics as the premise fiber optic cables.

2.15 CIRCUIT PROTECTORS

A. General

1. The circuit protectors shall be UL listed, complying with National Electrical Code, ETL Tested and Certified to comply with or exceed Specified Requirements, ANSI/TIA/EIA-568C including related Standards, Amendments and TSB.

B. Circuit Protectors

1. Cables containing non-dielectric electrical conducting components entering from the exterior of the building shall be provided with individual circuit protectors combining both lightning circuit protection and SPD circuit protection on each circuit conducting component, as required in CEC Articles 770 and 800.
2. Install circuit protectors in the respective backboard/equipment rack where copper wire conductors terminate, connect each protector to room/closet ground bus equipment with #10AWG green insulated bond/ground copper conductors.

PART 3 - EXECUTION

3.1 NETWORK CABLE TESTING AND COMMISSIONING (ADDITIONAL REQUIREMENTS)

A. General

1. In addition to the testing recommended in ANSI/TIA/ EIA-568C and related Standards, Amendments and TSB. End-to-End test 100% of all individual optical fiber, individual copper wire conductors, each outlet and each connector in all terminated and unterminated cables, portable patch cord, outlets and patch panels provided in the Contract, shall be tested after installation as a complete channel pathway installation, splicing outlets and termination is completed, including the following end-to-end tests on each installed individual circuit;

   a. Each circuit wire and fiber map and length
   b. Each circuit insertion Loss
   c. Each circuit NEXT (Pair-to-Pair) Loss
   d. Each circuit NEXT Loss (Power Sum) PS
   e. Each circuit ELFEXT Loss (Pair-to-Pair)
   f. Each circuit ELFEXT Loss (Power Sum) PS
   g. Each circuit return Loss (RL)
   h. Each circuit propagation delay
   i. Each circuit propagation delay-skew

2. The test equipment and (Tester) shall comply with the Accuracy Requirements for Field Testers as defined in the ANSI/EIA/TIA Standards for the specific cable type. The Tester including the appropriate interface adapter shall meet the Specified Accuracy Requirements. The Tester shall be within the calibration period recommended by the Vendor in order to achieve the Vendor-specified measurement accuracy. The Tester shall be calibrated to extend the reference plane of the Return Loss measurement

to the permanent link interface. The Contractor shall provide proof that the interface has been calibrated within the period recommended by the Vendor.

3. The Pass or Fail condition for the channel pathway link-under-test is determined by the results of the required individual tests (ANSI/EIA/TIA) Any Fail result yields a Fail for the link-under-test. In order to achieve an overall Pass condition, the results for each individual test parameter must Pass. A Pass or Fail result for each parameter is determined by comparing the measured values with the ANSI/EIA/ TIA test limits for that parameter. The test result of a parameter shall be marked with an asterisk (*) when the result is closer to the test limit than the accuracy of the field test. The Field Test Equipment Manufacturer shall provide documentation as an aid to interpret results marked with asterisks.
4. Provide all test equipment, Certified Testing Personnel, and setups. Shall comply with ANSI/EIA/TIA and Equipment Manufacturer's recommendations and standards of practice.
5. Provide six copies of all test reports, bound in three ring binders. Provide three digital CD/DVD ROM copies. Organize test reports into rows-and-columns spread-sheet format, with data common groupings by IDF and NDF location. Submit to Owner's Representative.
6. The Contractor shall repair or replace equipment, cables, outlets, connectors, splices, terminations, etc. identified during testing as not complying with the Contract Documents, without additional cost to the Contract. Retest all replaced or repaired components at Contractor's expense.

B. Twisted Pair Copper Wire Testing

1. Channel insertion loss (dB).
2. Channel near-end cross-talk NEXT loss (dB).
3. Channel equal-level far-end cross-talk ELFEXT (dB).
4. Channel return loss (dB).
5. Channel power sum PSACR (dB).
6. Channel propagation delay, propagation speed, and delay skew.
7. Channel wire map and circuit length.
8. Channel ring-out test for continuity and correct point-to-point matching terminals.
9. Channel DC resistance and capacitance.
10. Channel attenuation-to-cross-talk ratio ACR.

C. Coaxial Cable Testing

1. Channel full specified frequency spectrum attenuation insertion loss (dB).
2. Channel wire mapping, ring-out and circuit length.
3. Channel propagation delay and propagation speed.
4. Channel impedance and continuity for center conductor and shields.

D. Fiber Optic Cable Testing, Optical Testing for Each Specified Wave-Lengths for Both laser and LED sources.

1. Channel link insertion losses (dB) OLTS.
2. Channel loop-back attenuation (dB).
3. Channel signature Optical Time Domain Reflectometer – OTDR, for installation characterization testing (event and attenuation resolution dead zone at specified wave lengths, shall be less than 10-feet).
4. Channel continuity and correct point-to-point matching terminals.
5. Channel propagation delay and propagation speed.
6. Channel fiber optic mapping, circuit length, and tracing.

3.2 FIBER OPTIC CABLE TYPE

A. General

1. Cables shown as fiber optic type shall comply with the following installation locations.
2. Provide matching compatible outlets and terminate all fiber optic cables into matching fiber optic connectors.
3. Fiber optic cable installed in indoor locations without enclosed raceway or conduit.

    a. Provide non-metallic, flexible corrugated continuous inner duct-raceway and install fiber optic cable in the innerduct.
    b. Innerduct shall be heavy duty, plenum-rated, Limited-Combustible (LC) type UL FHC – 25/50, orange color. Support innerduct 36-inches on center, independent of ceiling supports and independent of other equipment supports.
    c. Innerduct size shall be selected to insure percentage-fill with fiber optic cables shall not exceed 30%, but in no case less than 1.25-inch diameter innerduct.

B. Provide loose tube gel filled or indoor/outdoor type fiber optic cable for any of the following installation location conditions.

1. Inter building (between buildings)
2. In a conduit or raceway located underground below grade.
3. In an exposed outdoor conduit or raceway not located underground or below grade.
4. Do not install loose tube gel filled type fiber optic cable inside a building or exposed on a building without providing Rigid Steel (RGS) conduit raceway for the loose tube gel filled fiber optic cable along the entire length of the cable inside the building or on the building.

C. Provide tight buffered or indoor/outdoor type fiber optic cable for any of the following installation location conditions.

1. Intra-building (inside a building) where raceway continuously encloses the cable and the raceway is not located underground, below grade.
2. In an exposed outdoor conduit or raceway not located underground or below grade.

D. Provide plenum rated type fiber optic cable for any of the following installation location conditions in building spaces.

1. Any building space air plenum (supply or return) when a conduit or enclosing raceway is not provided for the entire cable length. Additionally, Cables shall be rated Limited-Combustible (LC) type UL FHC-25/50.
2. All building space locations where the cable is installed without a conduit or the cable is not fully enclosed in a raceway along the entire cable length in a building. Additionally, Cables shall be rated Limited-Combustible (LC) type UL FHC-25/50.
3. Building spaces and/or cavities that are 100% fully protected with fire sprinklers, including fire sprinklers located above in ceiling cavities and fire sprinklers located below in access floor cavities. Cables installed in these locations shall be rated with one or more of the following additional characteristics.

    a. Limited–Combustible (LC) UL FHC-25/50 plenum rated cable.
    b. Or plenum rated cable without the UL FHC-25/50 Limited-Combustible (LC) rating.

E. Optical Fiber Quantity:

1. The minimum fiber quantities in each fiber optic cable shall be as follows, but in no case less than indicated on the Drawings.

2. Between main IDF (SUB-MDF) in separate buildings and the MDF main terminal rack fiber optic patch bay for the entire site/campus.

    a. Twenty-four optical fibers, multimode plus six optical fibers, single mode.

3. Between satellite IDF terminal rack fiber optic patch bays and the main terminal rack IDF (sub-MDF) patch bay located in the same building.

    a. Twenty-Four optical fibers, multimode plus six optical fibers, single mode.

4. Between a terminal rack patch bays (IDF or MDF):

    a. To an individual workstation outlet located inside the same building - two multimode optical fibers, (typical only for locations where fiber is specifically shown on the Drawings for the specific work station outlet).
    b. To each network file server outlet location whether or not shown on the Drawings, four optical fiber, and multimode.

5. Between a terminal rack-patch bay and individual multimedia network (television/video/audio) workstation outlets and/or intrusion/access program display devices located inside the same building - two optical fibers, multimode.
6. Other locations as indicated on the Drawings or described in the Contract Documents.

3.3 COPPER WIRE CABLE TYPE

A. General

1. Cables shown as copper wire type shall comply with the following installation conditions, unless noted otherwise on the Drawings.
2. Provide matching compatible outlets and terminate all copper wire cables into matching copper wire connectors.

B. Cable Types and Quantities - Cable types and quantities shall be as follows unless specifically noted other-wise on the Drawings. The following minimum type and quantity of copper wire cables from each individual workstation/device outlet, to the respective terminal equipment patch panel/bay, (unless specifically noted otherwise), but in no case less than what is shown on the Drawings and in no case less than one 4-pair cable to each outlet “Jack” position:

1. Two Category-6A, UTP 4-pair cable:

    a. Each network workstation outlet location.
    b. Each network “wireless-access-point” outlet location.

2. One Category-6A UTP 4-pair cable, for each telephone handset (instrument) workstation outlet location.
3. Trunking-Cables shall be Category-5E.

    a. 100-pair between buildings main IDF (SUB-MDF) and campus main MDF.
    b. 50-pair inside building between SUB-IDF to buildings main IDF (SUB-MDF).

4. Other locations as indicated on the Drawings or described in Contract Documents.

C. Provide plenum rated copper wire cable for any of the following installation location conditions in building spaces.

1. Any air plenum (supply or return) when a conduit or enclosed raceway is not provided for the entire cable length. Additionally, cables shall be rated Limited-Combustible (LC) type UL FHC-25/50.
2. All building space locations where the cable is installed without a conduit or the cable is not fully enclosed in a raceway along the entire cable length in the building. Additionally, cables shall be rated Limited-Combustible (LC) type UL FHC-25/50.
3. Building spaces and/or cavities that are 100% fully protected with fire sprinklers, including fire sprinklers located above in ceiling cavities and fire sprinklers located below in access floor cavities. Cables installed in these locations shall be rated with one or more of the following additional characteristics.

    a. Limited–Combustible (LC) UL FHC-25/50 plenum rated cable.
    b. Or plenum rated cable without the UL FHC-25/50 Limited-Combustible (LC) rating.

D. OSP Insulated Copper Wire Cables

1. Outside – Plant (OSP) CEC/NEC rated, UL listed, labeled and approved insulated copper wire cable assemblies. Moisture barrier resistant and UV resistant cable jacket. Non-flammable, water blocking, non-conductive gel internally filled infrastructure cable assembly.
2. Provide rated insulated copper wire OSP type cable for any of the following copper wire infrastructure cable install locations.

    a. In underground conduit or in conduit under the building.
    b. In conduit exterior to the building, or in conduit exposed outdoor on the building.
    c. Outdoor aerial with aerial messenger wire cable carrier.

3. Except for aerial install locations, install all OSP cable in continuous conduit pathways, end-to-end.

3.4 CABLE INSTALLATION

A. General

1. Cables connecting to equipment racks and terminal blocks shall be installed with not less than 6-feet of slack cable between the equipment rack/terminal block and terminal backboard. The slack cable shall be coiled and supported on the backboard and/or cable tray.
2. Cables in terminal closets and terminal rooms shall be trained, dressed and racked on the plywood backboards. Provide cable, metal support arms and re-enterable type cable support rings not less than 12-inches on center mounted onto the plywood along the entire length of all cables.
3. Provide separate routing paths on plywood backboards for fiber optic cables, computer data and copper wire cables and telephone/voice copper wire cables and multimedia, audio/video, TV cables. Provide separate routing paths on plywood backboards for shielded copper wire cables and unshielded copper wire cables.
4. Cables shall be routed parallel to floors and walls. Do not route cables diagonally on backboards.

5. Spare cable slack

   a. Provide 25-feet of cable slack where unterminated cables are specified at terminal backboards.
   b. Provide a minimum of 18-inches of slack cable in each workstation outlet box and outlet locations.
   c. Provide 10-feet of cable slack in ceiling above each work station outlet.
   d. Provide 24-inches of slack in each cable at patch panel locations.
   e. Coil and "Velcro" wrap slack cable.

6. Provide “horizontal wiring” cables installed from individual equipment locations and workstation outlets to respective MDF/IDF terminal closet/room patch panel. Cables shall be continuous without cutting or splices.
7. Provide “backbone” cables installed from each IDF location to respective MDF/Sub-MDF location terminal closet/room patch panels. Cables shall be continuous without cutting or splices.

B. Cable Pulling Lubrication

1. Cable pulling lubricants shall be specifically approved by the Cable Manufacturer. The following lubricants shall be used where approved by the Cable Manufacturer.

   a. Slip X -300, American Colloid Co.
   b. Bishop #45, Bishop Electric.
   c. MacLube CA51, MacProducts.
   d. Minerallac H2B,- Minerallac Electric.
   e. Winter grade #7437-PC, General Machine Products.
   f. Gel-lube 7/5, Cable associates.
   g. Polywater, A, C, G - American Polywater.

2. Lubricants shall be continuously applied as cable enters raceway.

C. Cable Installation:

1. Do not pull conductors until factory test reports have been submitted and reviewed.

2. Minimum bending radius of fiber optic cables shall not be less than the following. Maximum pulling tension shall not exceed the following. In no case shall the Manufacturer's recommendations be violated.

Cable Type	Cable Fiber Quantity	Minimum Bend Radius	Maximum Pulling Tension
Loose Tube	2-84	9 inches	600 pounds
Loose Tube	86-192	10 inches	600 pounds
Tight Buffered	2-12	5 inches	400 pounds
Tight Buffered	14-24	7 inches	600 pounds
Tight Buffered	26-28	11 inches	1100 pounds
Tight Buffered	48-72	12 inches	1200 pounds

3. The minimum bending radius for copper wire cables shall be 10 times the cable outside diameter. The maximum pulling tension and minimum bending radius shall not violate Manufacturer's recommendations.
4. Cables installed in manholes and pullboxes on terminal backboards shall be installed on wall mounted cable support racks.
5. Provide a full 360-degree loop of cable around manhole and pullbox interiors.

6. The attachment of pulling devices directly to the cables shall be with individual split mesh basket grips. Direct connection for pulling cables to cable fibers and copper wires shall not occur. Securely tape cable ends to prevent moisture or pulling compound from penetrating cable.
7. The attachment of the pulling device to the cable basket grips shall be made through a swivel connector.
8. The Contractor shall ensure that the cables are fed straight into the raceway taking care to avoid short bends, sharp edges and cable "cross-overs".
9. All lashings used for temporary bunching of the individual cables shall be removed before the cables enter the raceway.
10. Cables shall be "pulled through" or pulled from a "center of run pull" without splices or terminations and minimize cable rolling tension. Lead-out the cables at all manholes, pullboxes and conduits taking care to feed them in again by hand for the next portion of the cable run.
11. For each cable pull where a cable direction change is required, flexible feed-in tubes, pullout devices, multi-segmented sheaves etc. shall be used to insure proper cable pulling tensions and side wall pressures. Cables shall not be pulled directly around a short right angle bend. Any device or surface the cable comes in contact with when under pull-in tension shall have a minimum radius 50% greater than the final specified minimum installed cable bending radius. The maximum possible size radius sheaves and feed-in tubes, usable in the available working space, shall be provided in all situations, to insure the minimum possible cable side-wall pulling pressure. Do not use devices with multi-segment "roller" type sheaves.
12. Cable lengths over 50 feet shall be machine pulled not hand pulled into and through all raceways. Cables shall be pulled in a continuous, smooth operation without jerking or stop-start motion after initiation of pull. Maximum cable pulling speed shall be less than 50 feet per minute. Minimum cable pulling speed shall be greater than 15 feet per minute.
13. Cables shall be pulled straight into or out of the raceway without bends at the raceway entrance or exit. Pull in cable from the end having the sharpest bend (i.e., bend shall be closest to reel). Keep pulling tension to minimum by liberal use of lubricant, hand turning of reel, and slack feeding of cable into duct entrance. Employ not less than one man at reel and one at manhole or pull-hole during this operation. Cables shall be pulled directly from cable reels.
14. Cables shall be trained or racked in trenches, vaults, manholes and pull boxes with consideration given for the minimum specified bending radius of the cable and the possibility of cable movements due to load cycling. The cables shall be racked and supported in such a manner that adequate space is allowed for splicing and the cables shall always be fanned out from the duct or conduit so as not to cross other ducts, conduits or cables. To prevent damage from falling objects or personnel entering the manhole the cables shall not pass directly under the manhole opening.
15. Cable shall be supported in manholes, pull boxes and vaults a minimum of 18-inch on center with cable racks. Provide hot dip galvanized, T-slot racks and support arms. Secure cables to racks with porcelain supports for each cable on the racks. Loosely lash cables to racks. Splices shall be directly supported, on racks. Do not install cables more than one feeder on the same rack hook.
16. Cables shall be routed the long way around manhole, pull-hole, etc. with not less than a full 360-degree loop around the perimeter walls unless noted otherwise.
17. Existing conductors shall be protected at all times when Contract work occurs in the same area, including but not limited to pullboxes, vaults manholes, cable trenches etc. Provide temporary electrical insulating blankets and barriers over existing conductors to reduce the possibility of accidental mechanical damage to existing conductors.
18. Where cable tray is provided, all cables shall be routed and trained on the cable tray. The cables shall enter the cable tray and route along the tray prior to entering any equipment racks or computer works station outlets.
19. A dynamometer to measure pulling tension shall be used on all cable runs in excess 200-feet or with more than 180 degrees in bends. The actual pulling tension value shall be calculated and recorded for each pull.
20. Bends shall not be made in cable splices or terminations.
21. The portions of cables installed without raceways or cable tray supports shall be installed with metal “J-hook” cable supports.

a. The "J-hooks" shall provide multi-tiered "J" shaped hooks, with wide flat cable support base (0.5 inch wide minimum) and smooth rounded corners. Specifically designed for copper wire and fiber optic infrastructure cable support as manufactured by Erico Inc.
b. The individual "J-hook" attachment to the building structure shall be metal, "beam clamp", "hanger rod", clevis hanger styles as applicable for each attachment location.
c. Install "J-hooks" not more than 48-inches on center along the entire cable length and within 6 inches of each cable change in direction. Locations of "J-Hooks" and tension of cables shall insure between 4-inches and 6-inches of cable sag between adjacent hooks. Secure cables to "J-hooks" with re-enterable cable tie wraps. "J-hook" supported cables, bundle cables together with re-enterable tie wraps not less than 12 inches on center along the entire cable length.
d. Each J-hook shall not support more than 12 individual cables. Provide multiple "tiered" J-hooks for additional cable quantities at each location.
e. "Bridle rings" shall NOT be used to support cables.
f. Cables shall not lie directly on nor attach to ceilings, ceiling hangers, lighting fixtures, air ducts, piping, or equipment.

22. Re-enterable cable tie wraps shall be, "limited-combustible" and air plenum rated, reusable, color coded. Chemically and mechanically compatible with the respective cables and install locations. Shall allow multiple open-close operations for securing cables.
23. Electronic network cables containing non-dielectric components shall be installed with a minimum separation from other electrical power conductors and equipment as follows:

	Equipment Type	Minimum Separation
a.	Lighting fixtures	12 inches
b.	Electric motors, electric solenoids, electric Heaters	40 inches
c.	Transformers	48 inches
d.	Circuits over 100 volts to ground, in metallic raceways	5 inches
e.	Circuits over 100 volts to ground, in non-metallic raceway or without any raceway	12 inches
f.	Circuits over 100 volts to ground, suspended on overhead pole lines	48 inches

D. Movement, Storage, and Handling of Cable:

1. Reels of cable shall not be dropped from any height, from trucks or other transporting equipment.
2. Lift and move cable reels using following methods:

a. Crane or boom type equipment-insert shaft (heavy rod or pipe) through reel hubs and lift with slings on shaft, with spreader or yoke to reduce or avoid sling pressure against reel head.
b. Forklift type of equipment may be used to move smaller, narrower width reels. Fork tines should be placed so that lift pressure is on reel heads, not on cable, and shall reach all the way across reels so lift is against both reel heads.
c. Reels may be moved short distances by rolling. Reels shall be rolled in the direction indicated by arrows painted on reel heads. Surfaces over which the reels are to be rolled shall be solid clear of debris, and also clear of protruding stones, humps, etc. which might damage the cable if the reel straddles them.

3. Storage of reels of cable:

a. Cable ends shall be sealed prior to shipment to prevent moisture entry into cable. Cable ends shall remain sealed at all times including during installation. Where ends seals are removed, reseal cable ends by stripping cable finishes back 2-inches down to insulation. Then apply four layers

of an insulating tape criss-cross over the cable end and carry back at least 4-inches onto cable outer finish. Add a containing cover of two layers of vinyl electrical tape completely over the end seal.

b. Cable reels shall be shipped with factory applied lagging (protective cover) left in place until removal is absolutely necessary. Additional covering such as tarpaulin, plastic sheeting, etc. shall be used if cable is to be stored outdoors.
c. Store reels of cable on a firm surface, paved, or on planking to prevent settling into soft ground.
d. Use fencing or other barriers to protect cables and reels against damage by vehicles or other equipment moving about in the storage area.

3.5 CABLE SPLICES

A. General

1. Splice(s) in cables shall occur only in the following locations:

a. Pullboxes or manholes.
b. Terminal backboard, closets or rooms.
c. Equipment racks.
d. Wall mounted interface cabinet.
e. Do not splice cables in conduit, cable tray, raceways or plenums.

2. Polarity and color-coding shall be maintained consistent through splices, terminations and outlets for the entire electronic network system.
3. Cable splices in outdoor areas, manholes, pullholes shall be water tight, inside universal splice enclosures.

B. Fiber optic cable splices unless specifically indicated otherwise below, fiber optic cable splices between fiber optic cables fibers shall be fusion type splices.

1. Splices between loose tube gel filled fiber optic cable fibers shall be fusion type splices.
2. Splices between indoor/outdoor fiber optic cable fibers shall be fusion type.
3. "Pigtail" splices of tight buffered and indoor/outdoor fiber optic cable fibers to loose tube gel filled cables shall be fusion type splice.
4. Splices between tight buffered fiber optic cable fibers to indoor/outdoor fiber optic cables shall be fusion type splice or mechanical type splice.
5. Splices between tight buffered fiber optic cable fibers shall be mechanical type splice or fusion type splice.
6. "Pigtail" splices of tight buffered fiber optic cable fibers to tight buffered fiber optic cable fibers shall be mechanical type splice or fusion type splice.
7. Fiber optic splices shall be performed to maintain the data transmission rates specified for the entire respective system.

C. Copper Wire Splice

1. Copper wire extending from infrastructure workstation outlets to respective equipment rack patch panel outlets shall not be cut or broken and shall be continuous end to end.
2. Copper wire extending from telephone/voice workstation outlets to respective terminal blocks shall not be cut or broken and shall be continuous end to end.
3. Continuity of cable shields (where occurs), polarity and color coding shall be maintained across all splices.

4. Copper wire splices shall be performed to maintain the data transmission rates specified for the entire respective system.

3.6 CABLE TERMINATIONS

A. General

1. Infrastructure workstation outlets connecting to ports in patch panels and terminal blocks shall be grouped together in the patch panel and terminal block by outlet function, room location and building area location (i.e. Group #l Room #120 1st floor; Group #2 Room #200 east wing, etc.). Each group shall be identified with engraved (etched) nameplates indicating grouping identification and individual port numbers.
2. Polarity and color coding of cable connections at splices, terminations and outlets shall be consistently maintained throughout the entire electronic network system.
3. Terminate all cables onto respective outlets connectors, interconnection couplers and terminals. Terminations shall comply with Manufacturer's recommendations; ANSI/TIA/EIA-568C related Standards, Amendments and TSB.
4. Fiber optic cable fiber strands and copper wire cable conductors terminated at outlet locations shall be connected with a strain relief device attached to the cable jacket to prevent cable tension from being transmitted to the termination connectors.
5. Cable terminations shall be performed to maintain the data transmission rates specified for respective entire system.

B. Fiber Optic Terminations

1. Individual fiber optic fibers shall each be terminated with a fiber optic fiber connector. The connector for each fiber shall be "plugged" into separate fiber optic fiber interconnection couplers on the rear of each respective outlet.
2. Each fiber optic termination ferrule shall be inspected, after completion of the termination, visually with a fiber optic inspection microscope and an interferometer, to insure fiber “undercut”, “protruding” fiber, over polish and under polish of fiber termination ends does not exist in the finished termination ferrule.
3. Fiber optic cables terminated between two fiber optic patch panels located in separate equipment racks. The fibers shall be paired together (Duplex-Pair) for purposes of identification and connection transmit/receive pair. Each pair of connectors for fibers shall be "plugged" into separate, physically adjacent fiber optic fiber duplex-pair interconnection couplers at each patch panel. The horizontal/ vertical arrangement of paired patch panel fiber couplers shall match at both ends of the fiber cable.
4. Fiber optic cable fiber strands terminated at patch panels shall be installed with a minimum of 540 degrees of each fiber strand looped around the splice tray individual fiber ”training” rings.
5. Fiber optic cable connecting from infrastructure workstation outlet to a fiber optic patch panel.

    a. The connectors for fibers shall be "plugged" into separate, physically adjacent fiber optic fiber interconnection couplers.
    b. The patch panel coupler shall be color coded to identify the polarity of the transmitting and receiving optical fibers.

6. Fiber optic cable connections at workstation outlets.

    a. The connectors for fibers shall be "plugged" into separate physically adjacent fiber optic fiber interconnection couplers in the outlet.

C. Copper Wire Terminations

1. Where occurs, the shield on metal shielded copper wire shall be terminated and connected to the shield grounding connection at each termination point.
2. Twisted wire pairs shall not be untwisted for a length of more than 0.4-inch at any location and the cable jacket shall not be striped back not more than 0.5 inch any location including splices and terminations.
3. Unless specifically directed otherwise by the Owner's Representative, Pin assignment for wiring terminations shall comply with ANSI/TIA/EIA-568C type T568A or Type T568B as required for compatibility with the electronic network equipment. The termination type shall be consistent throughout the Project Contract area.
4. Copper wire termination's shall be performed to maintain the transmission rates specified for the respective entire system.

3.7 EQUIPMENT RACKS

A. General

1. Install, assemble, mount and connect devices and equipment in the respective equipment racks, bolted securely to the rack frame with stainless steel hardware. "Star" style lock washers shall be provided to insure an electrically continuous ground path between the equipment/devices and rack frames.
2. Provide blank metal filler panels to close unused equipment "front" mounting space in equipment racks, Manufacturer's standard finish color.
3. Provide a copper wire outlet connector in the respective equipment rack for each remote copper wire infrastructure workstation outlet and copper wire cable shown connected to the respective equipment rack, plus the spare copper wire outlet connectors required in the Contract Documents. The copper wire outlet connectors in the equipment racks shall be provided in equipment rack mounted copper wire patch panels. In no case shall the quantity of equipment rack mounted copper wire outlet connectors be less than the quantity of cables indicated on the Drawings, plus required spaces/spares.
4. Provide fiber optic fiber connectors and fiber optic fiber interconnection couplers in the respective equipment rack for each remote fiber optic infrastructure workstation outlet, and fiber optics cable fiber shown connected to the respective equipment rack, plus the spare fiber optic fiber connectors required in the Contract Documents. The fiber optic fiber connectors and fiber optic fiber interconnection couplers in the equipment racks shall be provided in equipment rack mounted fiber optic fiber distribution enclosures (RTDE). In no case shall the quantity of equipment rack mounted fiber optic fiber connectors and fiber optic fiber interconnection couplers be less than the quantity of cables indicated on the Drawings, plus required spaces/spares.
5. Fiber optics cable fibers specifically shown as non-terminated "splicing-thru" in the equipment rack shall route through fiber optic splice only enclosures (RMSE), mounted in the respective equipment rack.
6. The maximum quantity of cable terminations, in each equipment rack mounted patch panels shall not exceed the following. To insure not less than 50% of the rack space remains available for equipment installation:

    a. 100% copper wire outlet connectors, 196 maximum per rack.
    b. 100% fiber optic fiber terminations, 144 maximum per rack.
    c. Combination of copper wire outlet connectors and fiber optic fiber terminations in the same rack; 48 maximum fiber optic fibers plus 144 maximum copper wire outlet connectors per rack. 18 maximum fibers plus 48 maximum copper wire in 30 inches high.
    d. In addition to the quantity of patch panel outlets for termination of incoming and outgoing cables, provide not less than an additional 15% of patch panel spare outlets of each type, in each equipment rack for future use.

7. Provide additional equipment racks, quantity of racks to ensure the maximum specified quantity of terminations in single rack are not exceeded and the quantity of cable terminations complies with the Requirements of the Contract Documents.
8. Terminal racks, equipment locations, patch panels, and cross connects shall be arranged to allow for natural cabling progression, minimize crossing of cables and allow easy access to each system component.
9. Equipment Rack Anchorage:

    a. Equipment racks installed on raised "access floor" systems, shall be supported and anchored with bolts that extend into the "structural" floor located below the "access floor".
    b. Securely anchor the support arms of swing gate racks to the wall structural support system.
    c. Securely anchor fixed support base of the racks to the floor.
    d. Mounting method shall support the total rack weight including installed equipment, but in no case less than 500 pounds with a 2.0 times safety factor.
    e. Attachments and anchorages shall comply with the Requirements for earthquake seismic rating at the install location.

10. Unless specifically noted, otherwise provide the following equipment rack types:

    a. Floor standing equipment racks containing patch panel locations, computer/data network HUBS/switches and computer data network concentrators, shall be Swing Gate style equipment racks.
    b. Floor standing equipment racks containing multimedia, audio/video, TV head end equipment, shall be Metal Enclosed equipment racks.
    c. Wall mounted external to dedicated IDF/MDF terminal rooms/closets (i.e. inside individual classrooms), shall be Mini-Equipment racks.

11. Install ground bus, PDU/SPD, cable management rings, equipment, patch panel and patch panel out-lets, etc. in equipment racks.
12. Equipment rack terminology:

    a. The location containing the main campus equipment rack location shall be identified as the Main Distribution Frame – (MDF).
    b. The locations remote from the MDF containing satellite equipment racks shall be identified as Intermediate Distribution Frames (IDF).
    c. A individual building located on a multi-building campus site with multiple equipment rack locations in the building, the building main rack location shall be identified as Sub-MDF (or building MDF) and the remaining equipment rack locations in the building shall be identified as IDF.

B. Floor Standing Equipment Racks

1. General:

    a. Securely anchor racks to floor.
    b. All incoming cables shall enter through the top or bottom of the racks.
    c. The front of the racks shall maintain a minimum of 42-inches of clear working space.
    d. Multiple floor standing racks shall be installed directly adjacent to each other (i.e. side by side), with not less than 6-inches (edge-to-edge) space between adjacent racks.
    e. Cables entering racks shall enter into the top of the rack from overhead cable tray, or from wall along wall support arms to rack.

2. Floor standing metal enclosed equipment racks:

   a. The rear of the rack shall maintain a minimum of 36 inches clear working space.
   b. Provide a minimum spacing between adjacent (edge-to-edge) racks of not less than 6-inches.

3. Floor standing open (non-swing gate) equipment racks.

   a. The rear of the rack shall maintain a minimum of 54-inches clear working space behind the rack frame rails for adequate installation depth of HUBS/switches equipment, for "walk" behind access to equipment and for cable terminations access.
   b. Provide a minimum spacing between (edge-to-edge) racks of not less than 6-inches.

4. Floor standing modular frame equipment racks:

   a. The rear of the racks shall abut against the wall, or as shown on the Drawing.

3.8 TELEPHONE/VOICE TERMINAL BLOCKS

A. The telephone/voice terminal blocks shall be assembled in vertical sections, for wall mounting. Install adjacent vertical sections with not less than 8-inch blank space between sections, for cable training space.

B. Install terminal blocks on plywood terminal backboard with #8 x 1-inch wood screws. Minimum 6-inches on center, along each side of each terminal block.

C. Terminal block wire pair capacity:

1. The minimum wire termination capacity shall not be less than 600 pairs of telephone/voice conductors, at any telephone/voice terminal block.
2. The quantity of wire pair terminations provided at each terminal block shall be based on the following formula. However, under no case shall any terminal block wire pair capacity be less than the specified minimum.

   Total quantity of telephone/voice feeder copper wire pairs connected to the terminal board = QFP
   Total quantity of telephone/voice outlets connected to terminal board - QTO
   (QFP) x (QTO x 4) + (specified spares) = Minimum terminal block pair capacity.

3.9 MDF AND IDF CIRCUIT TERMINAL ROOMS AND CLOSETS

A. Terminal Backboard

1. A ¾-inch thick marine "A-C" grade plywood backboard shall fully cover each wall of terminal closets and terminal rooms, including all MDF and IDF rooms/closets. Provide backboard on the wall for equipment racks, incoming cable raceways and terminal blocks. Plywood shall extend continuous from the finish floor to 8-feet above the finish floor on all walls. "A" side of plywood shall be exposed.
2. Attach plywood to wall structural framing with mechanical fasteners a minimum 6-inches on center vertically on walls at each framing vertical member, and along the length of the wall, but not less than 16 inches on center horizontally along the length of the wall.
3. Paint plywood terminal backboards after installation and prior to mounting any equipment. One coat of wood paint fire resistant primer and two coats of fire resistant/intumescent, non-conductive finish coats of paint. Finish color matt/ flat white, acrylic enamel fire resistant/retardant latex paint.

B. Cable Tray

1. Locations with equipment racks, and/or terminal blocks are installed in the same room/closet (MDF or IDF).

    a. Provide a horizontal cable tray above the equipment racks and terminal blocks in each circuit terminal room and closet.
    b. Provide a horizontal cable tray continuous "loop" around the perimeter inside each MDF and IDF room, within 12-inches of the ceiling. Parallel with and adjacent to all walls in the room.

2. Ladder type cable tray 18 inches wide by 6 inches deep; length-end wall to end wall, of the closet or room.
3. Install the cable tray centered above all equipment racks, and around the room perimeter at ceiling/ walls and terminal blocks with ceiling and wall suspension system. Install trays not more than 36-inches above and not less than 12-inches above the top of the equipment racks.
4. Where multiple segments of cable trays occur in terminal closets and rooms, provide interconnecting cable trays between each segment located in the respective room/closet.

C. Conductor Training and Support

1. Provide conductor/cable training and racking support distribution rings installed on backboards. As manufactured by Newton 3042 series, Saunders or equal.
2. Support rings shall be spaced a minimum of 10-inches on center along all cable/conductor routing paths on backboards and within 4-inches of each change in cable/conductor direction.
3. The capacity of support rings shall be equal to the weight and quantity of conductors/cables passing through the respective support ring plus 100% spare capacity for installation future conductors/cables. In no case shall support rings be smaller than 3 inches.
4. Attach support rings to backboards with not less than two 3/8-inch diameter by 1⅛-inch long threaded wood anchor bolts for each individual bracket.

D. Environment Space Monitoring (MDF and IDF)

1. In each room/closet provide one automatic environmental monitor. Self-calibrating, simultaneous monitoring and software programmable, with alarm set points. Shall measure and monitor ambient conditions and provide data-logging for conditions in the space for the following:

    a. One ambient temperature port and plug-in indoor sensor.
    b. One ambient humidity port and plug-in indoor sensor.
    c. One spare plug-in port for an external digital sensor.

2. Digital Fast Ethernet LAN RJ-45 communications port, with alarm alerting and communications software for remote monitoring of the ambient conditions via the LAN. Multi-user site wide software license, compatible with PC-computer and IP-WEB HTTP remote operations.
3. Local internal audio and visual alert annunciators, with local silence and reset.
4. 120 volt, 60Hz AC input power supply operation. Equipment rack mount self-contained unit housing configuration. Provide all interconnect cabling and connectors.
5. Provide the environmental unit in one of the equipment racks located in each of the respective spaces.
6. As manufactured by Avtech-Room Alert; or SensaTronic-Evironmental Systems; or IT Watch Dog-Climate Monitors.

3.10 GROUND (ADDITIONAL REQUIREMENTS)

A. Electronic Equipment MDF, IDF and Terminal Rooms and Closets

1. Terminal Equipment Ground Bus (TEGB) - Provide a wall mounted TEGB ground bus in each MDF location. Also provide a TEGB where two or more equipment racks and/or terminal blocks are provided in each IDF. The TEGB ground bus shall be copper ¼-inch by 2-inches (nominal) by 12-inches long (minimum). Install the TEGB on the wall with a minimum of two "stand-off" electrical insulators. Drill and tap the ground bus and provide bolted type ground lugs for connection of each ground conductors size #10AWG - #1AWG. Provide four spare unused ground lugs on the TEGB.
2. Provide 1.25-inch conduit with 1#1AWG copper insulated ground conductor from the TEGB homerun to the building main ground reference bus. Provide 1.25-inch conduit with 1#1AWG copper insulated ground conductor from the TEGB homerun to the nearest building main structural steel member and to the nearest metal cold water pipe larger than 0.6-inch diameter pipe.

    a. Provide the same ground connections from the equipment rack ground bus where only a single equipment rack occurs in the IDF location.

3. The ground conductor required from the TEGB to the building main ground reference bus may be looped and connected between separate TEGB ground bus locations if all of the following conditions are met.

    a. The ground conductor is increased to 1.5-inch conduit with 1#2/0AWG copper insulated and the total end to end length does not exceed 300-feet.
    b. The building exceeds two floors in height.
    c. Not more than four TEGB buses are connected to the same "looped" ground conductor.
    d. The TEGB ground conductor is continuous (not cut, spliced or broken) along its entire length.
    e. The TEGB ground conductor is connected to the TEGB ground buses with a UL listed "Exothermic" welding process.

B. Equipment Racks:

1. Provide a separate 12AWG copper stranded green insulated ground conductor from each individual equipment element in the rack to the respective rack ground bus.
2. Provide a separate #8AWG copper insulated ground conductor from each equipment rack ground bus to the TEGB terminal equipment ground bus located in the same space.
3. Where only one equipment rack is installed, provide 1.25-inch conduit with 1#1AWG copper insulated ground homerun conductor from the equipment rack ground bus homerun to the building main ground reference bus and provide 1.25-inch conduit with 1#1AWG copper insulated ground conductor from the TEGB or single equipment rack ground bus (as applicable), to the nearest building main structural steel member and to the nearest metal cold water pipe larger than 0.6-inch diameter pipe.
4. Provide 1.25-inch conduit with 1#4AWG copper insulated ground conductor from each wall mounted fiber interface cabinet to the respective TEGB ground buses.
5. Provide a 1#10AWG copper insulated ground conductor connecting in a continuous loop to all miscellaneous cable trays and metal support equipment located in the terminal closet or room and connect to the TEGB ground bus.

C. Telephone/Voice Terminal Blocks:

1. Provide a separate #8 copper insulated ground conductor from each terminal block section ground bus to the TEGB terminal equipment ground bus.
2. Provide a separate #6 copper insulated ground conductor from the terminal room/closet to the lightning ground system.

3.11 WALL MOUNTED FIBER INTERFACE CABINET - WMIC

3.12 IDENTIFICATION (ADDITIONAL REQUIREMENTS)

A. General

1. Fiber optic and copper wire cables shall be identified in each manhole, pull box, equipment rack, patch panel and computer workstation outlets.
2. Infrastructure documentation, identification labels and color coding shall comply with ANSI/TIA/EIA-606A Administration Standard for Telecommunications Infrastructures, Class-1 thru Class-4. Provide management software MS-Windows-based single user license, with all as-built data entry documentation information complete.

B. Identification tags shall include the following information:

1. Cable name as indicated on Drawings (i.e., HV1, F4, MSB3 etc.).
2. Installation month and date (i.e., 3/92, 4/78 etc.).
3. Conductor size conductor type (i.e., loose tube fiber; #24AWG ScTP Category 5, 200-pair, tele-phone/ voice etc.).
4. Feeder taps to equipment or building shall also be identified with equipment name or building (i.e. library, SW1, Rack #21, etc.)

C. Identification Tags

1. Tags shall be ⅛-inch thick 98% lead, approximately 2-inch square with chamfered corners. Two holes shall be drilled for attachment to primary cable. Lettering shall be ⅛-inch high, engraved or die stamped. Attach tags to primary cables with two #14AWG (THWN insulated) solid copper conductors "twist-tied", with insulated CAP wire-nut on the tie-wire ends, to cover sharp edges of tie-wire conductor.
2. Alternate identification tags, at the Contractor's option in lieu of lead tags. Provide polypropylene tag holders with interchangeable, yellow polypropylene tag with black alphanumeric characters sets. Characters shall be approximately .25-inch high. As manufactured by Almetek industries "EZTAG" - Ledgewood, New Jersey.

D. Equipment and outlet naming identification and color-coding shall comply with ANSI/EIA/TIA latest revision.

1. Naming method for equipment, outlets and cables; where a position in the naming string is unused, provide multiple "****" symbols.

   Typical naming string "ADM-02-1141-PP17-1271"

   a. "ADM" - Abbreviated Building Name or Number (i.e., Administration, B127, etc.)
   b. "02" - Floor Level #2 or as applicable.
   c. "1141" - Outlet, Equipment or Terminal Room/Closet name or room number as applicable.
   d. "PP17" - Terminal Rack Patch Panel Identification.
   e. "1271" - Individual Outlet or Port Identification.

2. Connecting hardware color coding shall be as follows:

   "Green" - Main central terminal location for entire site.
   "White" - Distributed terminal locations other than the main terminal.

"Blue" - Horizontal wiring hardware systems for workstations.

E. Provide warning nameplates on fiber optic patch panels, fiber optic outlets, and any location where fiber optic cables are terminated. Minimum ⅛-inch high engraved/etched letters. "WARNING - LASER LIGHT SOURCE. DO NOT LOOK DIRECTLY AT OUTLET OR FIBER CABLE ENDS. RISK OF SEVERE EYE DAMAGE OR BLINDNESS".

END OF SECTION 272000
040119/212227

SECTION 273000 – AREA OF REFUGE - TWO-WAY COMMUNICATION SYSTEM
IP Command Center (Base Station and Distribution Module), Call Boxes and Signage

PART 1 - GENERAL

1.1 SUMMARY

A. The IP Command Center is to be located at a central control point on the first floor or as determined by local Authority Having Jurisdiction. RATH® Command Center IP Call Boxes are to be located on all floors above and below the first floor, ideally next to a stairwell emergency exit or elevator landing on each floor.

B. The IP Command Center must be capable of connecting to an existing Network and providing inputs for the IP Call Boxes. Visual indicators on the IP Command Center allow rescue personnel to know which IP Call Box needs assistance. The IP Command Center must allow rescue Personnel to speak to each IP Call Box individually. The IP Command Center must include both a handset and speakerphone to communicate back to the IP Call Boxes.

C. The emergency communication hardware shall comply with the Americans with Disabilities Act (ADA). The IP Call Box shall have the ability to be programmed with up to two emergency phone numbers (either both off-site or Base Station and off-site). Upon activation of the emergency push button, a call will be automatically placed to the IP Command Center. If no one answers at the IP Command Center, the IP Call Box must dial a secondary location outside the building to activate two way off-site person to person voice communications.

1.2 SUBMITTALS

A. Submit product data sheets. Include operation manuals.

B. Wiring or shop diagrams detailing wiring schematics, cabling.

1.3 CONSTRUCTION

A. The IP Command Center (2500 Series) shall include both the Base Station and Distribution Module. The Base Station must have a powder coated steel housing (surface or flush mount) or be desk mounted, include a black handset with coil cord and be powered from the Distribution Module.

B. Distribution Module must be a surface mount enclosure, include connections for the IP Call Boxes and power the Base Station. The Distribution Module shall be powered from 120vac power with a battery backup that provides power for a minimum of 4 hours (RATH® part # RP7700104).

C. The IP Call Boxes (2100 Series) must be in full compliance with the ADA. IP Call Boxes require a hands-free speakerphone with an LED to indicate status of call.

D. The IP Call Boxes must allow the programming in of a specific location message of the unit. This allows rescue personnel to know the location of the activated IP Call Box.

E. The IP Call Boxes are to be located no higher than 48-inches reach to the center of the push button above ground level to ensure conformance with the ADA Requirements.

F. The IP Call Boxes must have a Braille face plate to ensure conformance with the ADA Requirements.

G. The IP Command Center must provide an audible and visual indicator that an IP Call Box has been activated.

H. The 120vac Power Supply RATH® part # RP7700104 must be capable of supplying power to a minimum of one Base Station and one Distribution Module.

1.4 MOUNTING

A. The IP Command Center is to be mounted on a flat wall surface or a desk top.

B. The IP Call Boxes are to be wall surface or flush mounted.

1.5 ELECTRICAL

A. The IP Command Center is to be powered by the Distribution Module. The IP Call Boxes are to be powered by PoE at 802.3af or a separate battery backed up 12v source.

B. Distribution Module shall be powered by the RATH® part # RP7700104 Power Supply. It shall require 120vac power and provide battery backup capable of providing a minimum of 4 hours of electrical backup in case of building power failure.

C. The Base Station shall connect to the Distribution Module with a single wire pair (10 zone) 2-wire pairs (16-64 zone) or 3-wire pairs (80-up).

D. Each IP Call Box shall connect to a local Network Switch directed to the Command Center Distribution Module. Wiring from the IP Call Box to the Network Switch shall be a minimum of Cat 5e or 6. If CI cable is required, utilize RATH® cable part # RP6600300M4.

E. System shall be in compliance with all state and local Electrical Codes.

F. If protective covers are required on the Call Boxes per local municipal codes, use RATH® part # 2100-XXXIPC2.

G. If the monitoring of system integrity is required per NFPA 72, use RATH® Supervisor part # 2500-VOIPM.

1.6 COMMUNICATIONS

A. The IP Call Boxes shall be an ADA compliant and vandal resistant speakerphone.

B. The IP Call Boxes shall be hands-free and be a push-button-once to talk system. Once the button has been pushed, the IP Call Box will call the Base Station. If no answer at the Base Station, it will automatically call a preprogrammed emergency number. The IP Call Box must be capable of being programmed with up to 2 emergency phone numbers (either both off-site or Base Station and off-site).

C. The IP Call Box shall have location message capability. The IP Call Box must have a minimum 18-second recordable message capability, programmable to play 1 or 2 times. IP Call Box shall notify called party of the location of the call upon being received at the emergency dispatch center.

D. The IP Call Box shall be capable of allowing the called party to replay the location message if necessary to ensure an understanding of the caller location.

E. If system is not attended to 24 hours a day, the IP Call Box must dial a secondary location outside the building to activate two way off-site person to person voice communications.

F. Once call has been made (button pushed), the call can only be terminated by the called party.

G. The IP Call Box must have a red LED that will light up upon push of the button. The light shall be a solid color when the IP Call Box is activated, and will flash when call has been answered.

H. The IP Call Box must be capable of being programmed and reprogrammed on-site.

I. Standard IP Call Box features:

1. Two number programming (either both off-site or Base Station and off-site)
2. Operating temperature of between -40˚F to +150˚F (-40˚ to + 65˚ C)
3. On-site programmable.
4. Powered from PoE at 802.3af or separate battery backed up 12v source
5. EEPROM memory to protect programming.

PART 2 - PRODUCTS

2.1 SIGNAGE

System shall consist of a minimum of one 120/277vac edge light sign (part # 7050 or 7050E), and a “location” and “instruction” sign (part # 7049) to clearly indicate location of designated area. A tactile sign (part # 7043/7044 or 7087) with raised letter and Braille shall be located at entrance to area.

2.2 GRAPHICS

A. IP Command Center must include wording identifying the location of each IP Call Box and light an LED when a particular IP Call Box has been activated.

B. The IP Call Box wording must include “Emergency Phone”, International Phone symbol and raised Braille lettering.

C. Cabling

1. Cabling for two-way communication system shall meet the applicable Requirements for pathway survivability. Cabling installation shall consist of the following:

a. 2 hour fire-rated circuit integrity (CI) cable – RATH® part # RP6600300M4
b. 2 hour fire-rated cable system
c. 2 hour fire-rated enclosure or protected area

2.3 WARRANTY

The IP Command Center and IP Call Boxes shall be warranted for a period of 3-years.

2.4 MANUFACTURER

A. The Manufacturer shall be:

RATH® Area of Refuge

N56 W24720 North Corporate Circle Sussex, WI 53089

800-451-1460

Website: www.Area-of-Refuge.com

END OF SECTION 273000
040519/212227

SECTION 274116 - AUDIO—VIDEO SYSTEMS AND EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL CONDITIONS

A. The Invitation for Bids, Instruction to Bidders and General Conditions of the Contract including any supplementary conditions apply to all work under this Section.

B. The Contractor acknowledges and warrants that he has closely examined all the Contract Documents, that they are suitable and sufficient to enable the Contractor to complete the work in the time allotted for the contract sum and that they include all work, whether or not shown or described, which reasonably may be inferred to be required or useful for the completion of the work in full compliance with all applicable Codes, Laws, Ordinances, Rules, and Regulations,

C. Execution of the Contract by the Contractor or his Representative and warranty that the Contractor has carefully examined the Contract Documents, and represents and warrants that the Contractor is thoroughly familiar with the nature and location of the work, the site, the specific conditions under which the work is to be performed, and all matters which may in any way affect the work or its performance. The Contractor further represents that as a result of such examinations and investigations, the Contractor has thoroughly reviewed and understands the contract documents and their intent and purpose, and is familiar with all applicable Codes, Ordinances, Laws, Regulations and Rules as they apply to the Work, and that the Contractor will abide by same.

D. Claims for additional time or additional compensation as a result of the Contractor's failure to follow the foregoing procedure and to familiarize it with all local conditions and the Contract Documents will not be permitted.

E. Related Work Specified Elsewhere:

1. All Division 1 Specification Sections apply to this Section.
2. Power, signal conduits and back-boxes provided and installed under Division 26; except loudspeaker back-boxes and specialty back-boxes provided under this work for installation under Division 26.

1.2 INSTRUCTIONS TO BIDDERS

A. Definitions:

1. Bidding documents include the proposed Contract Documents, which consist of the Project Specifications herein and the associated Telecommunications Drawings.
2. A bid is a complete and properly signed proposal to do the work as described in the Contract Documents, for the sums stipulated therein, submitted in accordance with the bidding documents.
3. The work includes all tasks necessary to complete the Contract as described in the Contract Documents.
4. A Bidder is a person or entity that submits a bid for coordinating and/or performing all the work as described in the Contract Documents.
5. A Sub-Bidder is a person or entity who submits a bid to a Bidder for materials, equipment, and/or labor for a portion of the work.

B. Bidding Documents:

1. Copies:

   a. Bidders shall be responsible for providing copies of the bidding documents to Sub-Bidders to solicit services to be Sub-Contracted.
   b. In making copies of the bidding documents available on the above terms, the AV Consultant does so only for the purpose of obtaining bids on the work and do not confer a license or grant permission for any other use of the bidding documents.

2. Interpretation or Correction of Bidding Documents:

   a. Bidders and Sub-Bidders shall carefully study and compare the bidding documents with each other to the extent that it relates to the work for which the bid is submitted, and shall promptly notify the Architect/Engineer of any ambiguity, inconsistency, or error which they may discover.
   b. Bidders and Sub-Bidders requiring clarification or interpretation of the bidding documents shall make a request to the Architect/Engineer through the General Contractor at least 5-working days prior to the date of receipt of bids. Requests for information (RFI) shall be written and faxed to the College. No questions will be answered by telephone.
   c. The Architect/Engineer will make clarifications by addendum and/or by written response if deemed necessary.

3. Addenda:

   a. Each Bidder shall ascertain, prior to submitting a bid that the Bidder has received all addenda issued, and the Bidder shall acknowledge their receipt in the bid.
   b. Consideration of bids

4. Rejection of Bids:

   a. The College shall have the right to reject any or all bids and to reject a bid not in compliance with Bidding Procedures and Requirements, no accompanied by data required by the bidding documents, or in any way incomplete or irregular.
   b. The College shall also have the right to reject any or all bids when, in their judgment, it is in their best interest to do so.

5. Acceptance of Bid:

   a. The College will be the final judge of which bid is accepted.
   b. The College shall have the right to waive informalities or irregularities in a bid received and to accept a bid which, in their judgment, is in their best interest.

C. Related Documents

1. Drawings and General Provisions of the Contract, including general and supplementary conditions and Division 1 Specification Sections, apply to this Section.
2. Telecommunications Drawings
3. Specification 275126 — Assistive Listening Systems (ALS).

1.3 SUMMARY OF WORK

A. The Contractor shall provide a complete turn-key solution with the equipment specified and additional parts required for a functional system.

B. Classroom Type 1 — Short Throw Projector

1. The audiovisual systems shall provide capability for presentations, and both audio and video playback. The following describes the equipment and capabilities of this room.
2. Video reproduction shall be via one wall-mounted 3300 lumen projector 800, 16:10 aspect ratio). The image shall be projected on an OFE whiteboard with the image filling the whiteboard top to bottom and the width as much as possible.
3. Stereo audio sources shall be summed and reproduced via four recessed loudspeakers in the drop tile ceiling. Audio content shall be a monaural output and evenly distributed through-out the ceiling using a 70V audio amplifier built into the switcher; the speakers shall be secured with a minimum of one seismic wire on each speaker to the hard-lid ceiling above the drop tile ceiling.
4. There shall be an Assisted Listening System (ALS) in each classroom with an inferred (IR) radiator and IR receivers (Stethoscope receiver, and Neck Loop for a T-Coil) for use by students with a hearing impairment.
5. There shall be one wireless lapel type microphone for use in the classroom. This shall be used for capturing the Instructor's voice for the ALS system and voice reinforcement for soft spoken instructors.
6. Sources shall include inputs with a HDMI and VGA/stereo audio cables for laptops and other portable equipment like a document camera if available.
7. There shall be one cable cubby in the AV rack/cart with one set of multimedia input cables (HDMI, VGA/stereo audio cables). These shall be located on the top of the rack/cart; the location in the top of the rack/cart shall be confirmed with the client and the cut out opening for the cubby shall be provided by the AVC.
8. There shall be a rolling AV rack/cabinet with doors front and back and a slim power strip with basic surge protection to house the AV equipment, cable cubby with control panel.
9. Control of the AV equipment and projector in the room shall be via control system in the AV switcher/scaler and through the control panel in the top of the cable cubby. The control system shall control source selection, ON/Off functionality for the complete system from a single button, room volume control, microphone volume level, and display image freeze if available. When a source button is pressed on the control panel, the displays shall turn on, switch to the appropriate input. Sources that have additional functionality or messages shall have a pop-up window with additional controls or text for the button that was pressed (Laptop — HDMI, Laptop VGA, Help Desk) to guide the user for additional action.

B. Classroom Type 2— Ceiling Mounted Projector

1. The audiovisual systems shall provide capability for presentations, and both audio and video playback. The following describes the equipment and capabilities of this room.
2. Video reproduction shall be via one ceiling-mounted 5000 lumen projector (1280 x 800, 16:10 aspect ratio). The image shall be projected on an OFE whiteboard with the image filling the whiteboard top to bottom and the width as much as possible.
3. Stereo audio sources shall be summed and reproduced via four recessed loudspeakers in the drop tile ceiling. Audio content shall be a monaural output and evenly distributed through-out the ceiling using a 70V audio amplifier built into the switcher; the speakers shall be secured with a minimum of one seismic wire on each speaker to the hard-lid ceiling above the drop tile ceiling.
4. There shall be an assisted listening system (ALS) in each classroom with an inferred (IR) radiator and IR receivers (Stethoscope receiver, and Neck Loop for a T-Coil) for use by students with a hearing impairment.
5. There shall be one wireless lapel type microphone for use in the classroom. This shall be used for capturing the instructor's voice for the ALS system and voice reinforcement for soft spoken instructors.

6. Sources shall include inputs with a HDMI and VGA/stereo audio cables for laptops and other portable equipment like a document camera if available.
7. There shall be one cable cubby in the AV rack/cart with one set of multimedia input cables (HDMI, VGA/stereo audio cables). These shall be located on the top of the rack/cart; the location in the top of the rack/cart shall be confirmed with the client and the cut out opening for the cubby shall be provided by the AVC.
8. There shall be a rolling AV rack/cabinet with doors front and back and a slim power strip with basic surge protection to house the AV equipment, cable cubby with control panel.
9. Control of the AV equipment and projector in the room shall be via control system in the AV switcher/ scaler and through the control panel in the top of the cable cubby. The control system shall control source selection, ON/Off functionality for the complete system from a single button, room volume control, microphone volume level, and display image freeze if available. When a source button is pressed on the control panel, the displays shall turn on, switch to the appropriate input. Sources that have additional functionality or messages shall have a pop-up window with additional controls or text for the button that was pressed (Laptop — HDMI, Laptop VGA, Help Desk) to guide the user for additional action.

C. Conference Rooms

1. Conference Rooms shall allow the end users to conduct meetings and presentations; there shall be sources such as a laptop, and other auxiliary portable equipment.
2. The Contractor shall provide and install one wall mounted 55-inches consumer LED flat panel display with a resolution of 1920 x 1080 (16:9) in the conference room.
3. Stereo audio sources shall be summed and reproduced via two loudspeakers mounted in the ceiling. Audio content shall be a monaural output and distributed throughout the ceiling using a 70V audio amplifier built into the switcher; the speakers shall be secured with a minimum of one seismic wire.
4. Audio and video from inputs in the flip-top cubby on the rack/cabinet shall be reproduced via the ceiling mounted speaker.
5. There shall be an assisted listening system (ALS) in the conference room with an inferred (IR) radiator and IR receivers (Stethoscope and Neck Loop for a T-Coil) for use by people with a hearing impairment.
6. There shall be a rolling AV rack/cabinet with doors front and back and a slim power strip with basic surge protection to house the AV equipment, cable cubby with control panel.
7. One flip-top cable cubby shall be mounted into the rack/cabinet in the conference room and shall connect laptop computers, and other auxiliary video equipment. The Contractor shall coordinate the integration of the cubbies into the rack/cabinet with the Architect and Owner. The cable cubby connections shall be VGA with stereo audio, and HDMI connection. Power and data connections shall also be available at the cable cubby.
8. The opening in the rack/cabinet top for the flip top cable cubby shall be provided by the AVC. Before cutting the openings in the table top the Contractor shall provide a Drawing of the table top indicating the cubby location for review and signoff by the College and Owner. Before actually cutting the Contractor shall markup the cubbies locations on the table top before making the first cut in the table top for a final review by the client.
9. One set of multimedia input cables (HDMI, VGA / stereo audio) shall be available for connection of auxiliary portable devices such as laptop computers in the room.
10. Control of the AV equipment and projector in the room shall be via control system in the AV switcher/ scaler and through the control panel in the top of the cable cubby. The control system shall control source selection, ON/Off functionality for the complete system from a single button, room volume control, microphone volume level, and display image freeze if available. When a source button is pressed on the control panel, the displays shall turn on, switch to the appropriate input. Sources that have additional functionality or messages shall have a pop-up window with additional controls or text for the button that was pressed (Laptop — HDMI, Laptop VGA, Help Desk) to guide the user for additional action.

D. Paging System

1. There shall be a paging system speaker provided and installed by the Contractor. The paging speakers shall be installed in the Lobby, and hallways (public and office areas) on the first and second floors. Refer to sheets ET-1.1 and ET-2.1 for the approximate speaker locations.
2. The headend of the paging system shall be in the IDF room with the telephone systems. The Contractor shall confirm the rack location and the connection to the telephone system for a line level output for the mixer/DSP unit. The Contractor shall work with the Colleges' IT Department to set-up and test the connection to the telephone system, and test the paging levels in all areas.

1.4 SCOPE

A. Supply and install sound and video systems including all apparatus and equipment, wiring, termination, labor, and services required to provide systems as specified and shown on Drawings.

B. If equipment has been discontinued or at "end of life", the equipment shall be substituted with the newest like model available from the same Manufacturer. If a different Manufacturer or model of equipment is to be substituted, the substitution must be reviewed by the Consultant and Client for approval.

C. Supply and install any incidental equipment needed in order to meet the Functional Requirements stated herein and on Drawings. This shall include all support and restraint for the fixed loudspeakers and projection equipment.

D. Set up and adjustment of specified hardware and software.

E. Furnish all test equipment and the services of the project engineer and the project manager to assist the College's Representative in the acceptance testing.

F. Make any adjustments to any part of the system, including the re-aiming of loudspeakers, which may be found necessary during the acceptance testing.

G. Provide training in the operation of the systems to the person or persons selected by the College.

1.5 COORDINATION:

A. Schedule installation operations in sequence required in order to obtain best completion results.

B. Coordinate the procurement and installation of the projection screens, projector mounts and all loudspeakers with the College.

C. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.

D. All specialty Sub-Contracting including coordination of all Telecommunications lines with other Sub-Contractors and equipment as shown on the Contract Documents to be coordinated by the Contractor.

1.6 EQUIPMENT AND MATERIALS

A. The Contractor shall verify characteristics of elements of interrelated equipment specified under this Section are compatible; coordinate work having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

B. By making requests for substitutions, the Contractor:

1. Represents that he has personally investigated the proposed substitute product and determined that it is equal to or superior in all respects to that specified.
2. Represents that he will provide the same warranty for the substitution that the Contractor would for that specified.
3. Certifies that the cost data presented is complete and includes all related costs under this Contract and waives all claims for additional costs related to the substitution which may later become apparent.
4. Will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects, including, but not limited to, in full compliance with all applicable Codes, Laws, Ordinances, Rules, and Regulations and completion in the time allotted for the Contract sum as accepted by the College and Architect/Engineer.

1.7 SCHEDULE

A. Within 10-calendar days of the receipt of the "Notice to Proceed" the Contractor shall prepare and submit for approval, in accordance with the general conditions, a schedule which shall include, but is not limited to, the following:

1. Submission of Shop Drawings, samples and layouts for all items described herein.
2. Start and Completion date(s) for field installation work.

    a. Installation date(s) of all wires and cables in conduits and required cable trays.
    b. Date when fully-operational equipment racks will be fully tested and ready for College's observation.
    c. Delivery date(s) of all systems and subsystems to the project site.

3. Start and completion date(s) for shop fabrication work.
4. Date of submission of samples for approval by the architect of all finishes/materials which will be visible to the public. Refer to Part 1 paragraph 1.8 entitled "Submittals" for additional information.
5. Programming of all remote control and digital signal processing driven devices.
6. Completion dates(s) for the following tests:

    a. Performance tests on all individual components as they are received from the Manufacturer in the Contractor's shop.
    b. Performance tests on completed assemblies and subassemblies assemblies, including all racks in the Contractor's shop,
    c. Performance tests on the completed systems as a whole prior to shipment to the project site.
    d. General performance testing of systems at the project site.

7. Completion dates for the following shop and field observations.

    a. Shop fabricated assembly and subassembly observation.
    b. Substantial completion observation at the project site.
    c. Final acceptance observation at the project site.

8. Submission date for operating, maintenance manuals, As-Built Drawings, documentation and closeout materials.

B. In the event the Contractor wishes to deviate from the schedule once it is established and approved, he may do so only after receiving written approval from the College.

1.8 SUBMITTALS

A. All submittals shall be in accordance with the general provisions of the contract, including general and supplementary conditions and other Division 1 Specification Sections.

B. Substitutions of equal equipment beyond the alternatives listed will be permitted only in accordance with Division 1. If a requested substitution requires a change in any of the Contract Drawings, a revised Drawing must be submitted as part of the substitution request. If an alternative listed is discontinued prior to installation, the Contractor shall submit a substitution request to provide the Manufacturer's replacement model. The College shall be the final judge of the acceptability of substitutions.

C. All Drawings shall be clear and legible. The minimum text size for all Drawings shall be 1/8-inch high.

D. Post Award Submittals: submit within 60 days of award.

1. Submit electronic reproducible Drawings (as .dwg and .pdf), documents (as .pdf) and software as per Manufacturer's directions of the following:

   a. A statement of Sub-Contractors, Franchises, Distributorship, Dealerships, Arrangements and Agreements with Manufacturers of equipment to be used for this work.
   b. Complete bill of quantities, including all material, components, devices and equipment required for this work. The bill of quantities shall be tabulated respective of each and every system as specified, in the order of the Specification Section 2 below, and shall contain the following information for each item listed:

      1) Quantity
      2) Description
      3) Manufacturer's name and model number
      4) Manufacturer's specification sheet

2. Samples of approval by the Architect of all finishes/materials which will be visible to the public. Including at least receptacles and controls with associates trim plate and each type of loudspeaker baffle and/or grille.
3. Schedule for work as described herein showing all major milestones.
4. Floor Plans, at scale of Contract Documents, showing the locations throughout the project of all receptacles, conduits, wireways, trays, pull boxes, junction boxes, equipment racks equipment and other devices with appropriate designations and fill.
5. Riser diagrams, showing all elevations, room numbers, conduit sizes, types and fills, box sizes and types, devices, equipment and rack designations.
6. Functional Diagrams: single-line block diagram showing interconnection of all components, receptacles, terminal blocks, controls, transformers and loudspeakers in addition to the active elements. Include terminal and cable numbers, all system and component labels. Show detailed system component information including but not limited to Manufacturer's name, model number, any specialized part number option and all input and output connection information, for each piece of equipment. No

Drawing codes shall be permitted. Mount one full-scale original or photograph (not blueprint) copy behind acrylic in the control booth for each system.

7. Equipment Rack Elevation Drawings scaled (1½-inch = 1-foot-0-inch or larger):

   a. Front Elevations: include equipment designation, Manufacturer's name, model number, rack location and rack designation.
   b. Rear Elevations: include AC power wireways and route of wiring harnesses.

8. Samples for approval by the Architect of all finishes/materials that will be visible to the public including at least receptacles and controls with associated trim plate and each type of loudspeaker baffle and/or grille.
9. Cable schedules and run sheets, associates with each equipment rack and/or any isolated piece of equipment or device, including cable designation, type, Manufacturer and Manufacturer's type number, wire color, device and terminal designation and device location, keyed to both the system block diagram and Equipment Rack Elevation Drawings.
10. Contractor fabricated items, detailed Drawings showing all components, devices and equipment, including dimensions, component values, terminal designations, types, locations, Manufacturer's name and model number.
11. Loudspeaker cluster and monitor loudspeaker supports stamped and signed by an Engineer licensed in the Project State. Include all loads, location of attachment to building structure, complete layout of all components, devices and equipment, including dimensions, methods of assembly, and connections to supporting construction, details of hardware, locations, Manufacturer's name and model number. All design calculations, loads, etc. shall be shown. Drawings shall be ¼-inch = l-foot-0-inch scale minimum. Permissible scales shall be ¼-inch, ¾-inch, l-inch, 1½-inch, and 3-inch = 1-foot-0-inch and full scale.
12. A bound volume or volumes of Comprehensive Specifications for all material, devices, components and equipment selected for use in this Section, whether modified or not, provided as required under "Post Award Submittals" above.
13. Control panel Layouts: Developed Drawings of all control system panel layouts.

E. Digital Signal Processor (DSP) System Submittal for CM Review:

1. Prior to programming the Digital Signal Processing (DSP) system, the Contractor shall submit shop Drawings per the Project Standards showing all screen layouts and control descriptions of all system functions to the College for review and comment prior to actual programming of the system. Shop Drawings shall include screen layouts of the DSP software "control pages" for all "configuration-presets" and "parameter-presets". Submit electronic versions of the DSP software to the Consultant for review and approval. The Contractor shall incorporate all College comments into the programming of the systems.
2. Prior to delivery of the systems to the job site, the Contractor shall demonstrate fully functioning systems in the Contractor’s facilities that include the DSP system programming. This demonstration shall coincide with the College’s Representatives observation of completed sub-assemblies (Refer to Part 3 paragraph entitled “System Performance Tests”). The College will review and comment upon the remote control programming, and the Contractor shall incorporate all College comments into the programming of the systems.
3. After the installation of the AV systems has been deemed substantially complete, but prior to final acceptance of the system, the College shall have a review period of 30-days to observe the operation of the DSP system. At the end of this review period, the College may request programming changes relating to the look and feel of the operation pages or the functionality of commands. The Contractor shall make these changes prior to acceptance of the systems.

F. Control System Submittal for Architect/Engineer review:

1. Prior to programming the remote control system, the Contractor shall submit Shop Drawings per the Project Standards showing all control screen layouts, graphical user interfaces (GUI) and control descriptions of all remote control system functions to the Architect/Engineer for review and comment prior to actual programming of the system. Submit in native file format and hard copy form. Shop Drawings shall include control screen layouts of the touch panel pages for each venue, web page layouts (as required in Part 2 below). Submit electronic versions for Architect/Engineer review. The Contractor shall incorporate all Architect/Engineer comments into the programming of the systems.
2. Prior to delivery of the systems to the job site, the Contractor shall demonstrate fully functioning systems in the Contractor's facilities that include the remote control programming. This demonstration shall coincide with the College's Representative observation of completed sub-assemblies (Refer to Part 3 paragraph entitled “System Performance Tests”). The Architect/Engineer will review and comment on the remote control programming submittal, and the Contractor shall incorporate all Architect/ Engineer comments into the programming of the systems.
3. After the installation of the AV systems has been deemed substantially complete, but prior to final acceptance of the system, the College shall have a review period of thirty days to observe the operation of the remote control system. At the end of this review period, the College may request programming changes relating to the look and feel of the remote control panels or the functionality of commands. The Contractor shall make these changes prior to acceptance of the systems.
4. Digital Signal Processing and control system programming files, touch panel, and other control page and Graphical User Interface layouts in native file format and hard copy form,

G. Shop Test Statement Submittals:

1. Submit electronically - photographs and state of the following prior to shipping fabricated equipment racks to Project site:

    a. A bound volume, or volumes, of results of performance tests and adjustment data, including all test procedures specified in Part 3 paragraph Error! Reference source not found. entitled “System Performance Tests”. Example shop test statement submittal templates are available from the AV consultant upon request.
    b. Submit a written request for equipment rack observation certifying that equipment racks are completely assembled, tested and ready for inspection.
    c. Detailed interior and exterior photos of assembly supporting claim for readiness for inspection.

H. Final Submittals: Submit the following Record Drawings developed from the final "As-Built" systems:

1. Two copies and one reproducible of each of the Block Diagrams, Plans, Risers, Patch Bay Drawings, Rack Elevations, Cable Schedules and Detail Drawings. All reproducible Drawings shall be submitted on CD-ROM.

    a. One complete set of Functional diagrams.
    b. One additional set of Rack Elevation Drawings and sheets provided in the Drawing package.

2. No more than 30-days after Acceptance Testing, submit two copies of each of the following equipment cut sheets and manuals prior to, and as a Requirement of, College acceptance of the work of this Section:

    a. Equipment operating instructions; complete, comprehensive instructions for the operations of all Contractor-fabricated devices and equipment items provided as part of the work of this Section.
    b. Manufacturer's cut sheets, installation, operating and service information including schematic diagrams for each item of equipment furnished. Order the equipment manuals in the order of the

Specifications. Provide tabs between each equipment manual. Provide a detailed index at the front of each manual indicating Specification reference number. Manufacturer's trade name, model number and part description. Provide two copies to the Architect/Engineer after they have been reviewed and approved by the Architect/Engineer.

c. Printed material within Contractor-fabricated equipment and systems operating manuals shall be bond paper copies, offset or letterpress printed. Drawings, charts and graphs shall be bond paper offset printed. The Systems Contractor-fabricated equipment instruction manuals shall be composed using a single, consistent visual format and writing style; text shall be derived from Component Equipment Manufacturer's instruction manuals and may include reproductions of artwork and other materials.

3. Submit two copies of each of the following schedules, lists, and data prior to, and as a Requirement of, College acceptance of the work of this Section:

a. All source code for any Contractor provided or programmed equipment on CD-ROM.
b. Final bill of quantities; complete bill of quantities all material as delivered, including a separate schedule of portable equipment.
c. Equipment schedule; complete, final schedules of equipment and devices provided in each room, by room number and name.
d. Performance, test and adjustment data; comprehensive documentation of all performance verification and correction procedures and measurements, including raw and equalized house curves and equalizer settings.
e. Maintenance and spare parts schedules; a comprehensive tabulation of equipment, devices, miscellaneous parts and maintenance items, including Manufacturer's name, address, model number, systems use and miscellaneous information,
f. No more than 30-days after Acceptance Testing, provide one copy of the following:

1) Certificates; any and all licenses, certificates of operation and/or compliance as required.

4. The system will not be accepted until these documents are reviewed and approved by the College's Representative.

1.9 QUALITY ASSURANCE

A. Unless otherwise stated, all electrical, electronic and optical equipment shall be a product of firms regularly engaged in the manufacture of electrical, electronic or optical equipment. The equipment shall be the latest model or type offered which meets the applicable Specifications at the time of the submittal. Discontinued items replaced by newer models or versions are prohibited and should not be submitted for review. It shall be the Contractor’s responsibility to provide the Architect/Engineer with information regarding discontinued products listed as alternatives in the Specification. If an alternative listed is discontinued prior to installation, the Contractor shall submit a substitution request to provide the Manufacturer’s replacement model.

B. Quality of workmanship and fabrication of all equipment and components, which are custom fabricated shall be comparable to processional equipment produced by specialized Manufacturers of the trade involved and shall be verified by observation. Only firms having 10 years’ experience in all aspects of the fabrication and installation of similar systems shall be allowed to perform the work.

C. All materials and products shall be new and of processional quality. Unless specifically stated in the Drawings or Specifications, no existing or pre-owned materials shall be installed.

D. The work specified herein, and in each of the allied Sections, shall be accomplished by a single Contractor experienced in the design, fabrication, installation, checkout and Warranty Contract management of systems such as those described in each Section. This Contractor shall have complete responsibility for the systems described herein and shall be the single Contact point for the Architect, Engineer and/or the College with respect to all work specified herein.

1.10 WARRANTY AND SERVICE

A. The Contractor shall warrant the installation free of faulty workmanship.

B. All components, including solid-state devices, warranted free of defects for a period of 1-year from date of final acceptance. This minimum warranty provision shall not diminish the terms of individual Equipment Manufacturers' warranties.

C. Paint and exterior finishes, fuses and lamps excluded from above warranties except when damage or failure results from defective materials or workmanship covered by warranty.

D. Provide maintenance service for a period of 1-year after acceptance of installation. Service to consist of at least two semiannual visits to the site software updates, and equipment adjustments. These visits should be coordinated with College or Representative.

E. Service request response time: Provide 2-hour via telephone / email, with 24-hour on-site technical response time. Provide a Technician on call from 7 a.m. to 9 p.m. 5-days a week.

F. All repairs must be completed within 10 business work days. If repairs cannot be completed within 10 working days, a replacement/loaner must be provided. If it cannot be resolved within the 10 days, the College Representative will have the option of getting it repaired with the Contractor covering the costs.

PART 2 - PRODUCTS

2.1 GENERAL:

Refer to the Telecommunication Drawings AV risers for Major Equipment and Approved Manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The following Installation Requirements shall govern the design, fabrication and installation of the system(s) specified herein. In case of a discrepancy between these overall system standards and the individual equipment item Specifications, the latter shall govern:

1. The equipment specified shall be installed according to standards of good human engineering practice and the conditions specified herein.
2. Workmanship on the installed systems shall be of processional quality, best commercial practice and accomplished by persons experienced in the techniques and standards of the particular industries involved.

3. The Specifications describe required performance. The Specifications with the Contract Drawings indicate a general design; it is the intention of the Specifications that the Contractor will supply from his background of experience and knowledge the necessary supporting details; for example, the implementation of specific components into functioning sub-systems.
4. In general, the Drawings show dimensions, positions, and kind of construction. The Specifications describe materials, qualities and methods. Any work called for on the Drawings and not mentioned in the Specifications, or vice versa, shall be performed as though fully set forth in both. In case of differences between the Drawings and the Specifications, the decision of the College's Representative shall govern. Work not particularly detailed, marked or specified, shall be construed to be the same as similar parts or areas that are detailed, marked, or specified.

B. Equipment markings shall present only needed information and be readable from the operator's normal work position. These markings shall be designed to minimize ambiguous interpretation.

C. Control panels shall be designed to reduce chances of human error and controls shall be natural and consonant with normal operator expectations.

D. All control consoles and their panel mountings shall be provided with the necessary controls, indicators and switches, etc., as outlined in the pertinent sections of this Specification. The grouping of these facilities shall be in accordance with the Associated Drawings and shall, in all cases, be arranged to present an orderly, functional appearance. The layout of controls shall be such that priority of accessibility shall be given to those facilities which frequently require attention.

E. The total design of the system shall simplify the operator's task and insure maximum performance and reliability while minimizing possibilities for human error and providing a comfortable environment for the operator during operation.

F. At the operational level (i.e., patch panels, AV equipment receptacle boxes, etc.) all receptacles shall be clearly marked by function and number. When there are multiples of the same function for example, a given microphone line may appear at several locations, the same label shall be shown at each location.

3.2 THE CONDUIT SYSTEM:

A. The Telecommunication Drawings indicate the number, type and location of the equipment. Wire and Cable Requirements and Equipment Room layouts, which are the responsibility of the Contractor. The conduit diagrams indicate schematically the functions served by the conduit system. Also, the conduit diagrams may indicate the locations at which functions are served at several locations in the facility. See the general installation notes for additional Information and Requirements as shown on the Telecommunication Drawings.

B. The Electrical Contractor is bound to provide the conduit system shown on the Telecommunication Drawings as part of the Base Building Contract.

1. If any portion of the conduit installation is concurrent with the AV Contract, the Contractor shall inspect the work at appropriate times during construction and report any discrepancies to the Architect and CM in writing. The Contractor shall coordinate the exact location of intermediate collector boxes behind the equipment rack with the Electrical Contractor.
2. The Electrical Contractor is bound to verify continuity of all conduits as described in the AV Category Drawings with a yellow pull string.

C. The Contractor shall be responsible for supplying any additional conduit that may be required to complete the system installation in accordance with the Drawings.

D. It shall be the responsibility of the Contractor to obtain the exact location of any pull boxes, “LBs" or other intermediate locations from the Electrical Contractor.

E. The Contractor shall also verify that conduits are adequate for the wiring and functions specified. If the Contractor substitutes the specified wiring the Contractor shall bear the sole responsibility for reengineering the conduit system,

F. The Contractor shall field verify all back box installation conditions on site and shall size connection panels as described below. Notify the Architect/Engineer of any discrepancies between Telecommunication Drawings and installation conditions.

1. Surface Mounted Back Boxes: Connection panels shall be sized to match the outer edges of the installed back box and shall have smooth edges.
2. Recessed Mounted Back Boxes: Connection panels shall be sized to overlap the outer edges of the installed back box by 1-inch in both horizontal and vertical directions and shall be installed tightly against the wall surface finish,

G. Each conduit shall contain wires or cable of the same signal level or the same type of circuitry only. Each separate service level designation shown on the conduit riser shall be run in their respective, separate conduits and all conduit landings in back-boxes or equipment racks shall be grouped by service level.

H. Ground power conduits to the power system ground. Do not connect power system conduits to the racks or to the audio system ground.

3.3 EQUIPMENT RACK ASSEMBLIES:

A. General:

1. Equipment rack shall be completely assembled, tested and programmed in the Contractor's shop. No rack assembly shall be performed at the Project Site. After the equipment rack is tested the Contractor shall notify the College's Representative in writing that the equipment rack assemblies are ready for observation and approval. Allow adequate time for any modifications necessary to satisfy the Contract Drawings and Specifications.
2. Use rear and mid rails for intermediate terminations. Maintain accessibility to the rear of the equipment.
3. Mid rails must be used to support equipment weighing more than 50 pounds.

B. Wiring Harnesses:

1. Equipment rack wiring shall be "Harness" style. "Point to Point" rack wiring is not acceptable. The individual wiring harnesses shall be located at the rear of the equipment rack on the sides and individual pairs of cable shall be broken out on to lacing bars to the back of the equipment to the connectors.
2. Electrical service levels shall not be mixed in an individual harness. It is the intent that there will be a separate harness for each electrical service level.
3. Great care shall be exercised to keep low level signal harnesses separated from the AC power lines and high level signal harnesses.

C. Equipment Labels:

1. Rack-mounted equipment shall be labeled on front and back, as to function using engraved black/white laminated plastic blocks. For example: LEFT HI- FREQ AMPLIFIER or CENTER EQUALIZER.

2. Use permanent processional quality labels such as "Gravelply" or approved equal. Stick-on strip labels such as those from Dyno or Brother are not acceptable.

D. Internal A/C Receptacles:

1. Maintain grounding as described in the herein.
2. Locate all internal AC receptacles on the left side of the rack and all harnesses on the right side of the rack. In the event that there are two equipment racks side by side locate the AC receptacles in the middle of the equipment racks and the wiring harnesses to the outer sides.

E. Installation:

1. No equipment may be installed prior to the following:

   a. The AV Consultant has performed the AV equipment rack observation in the Contractor's shop.
   b. Any and all punch list items described as 'minimum to enable rack delivery to site' have been addressed, proof has been submitted to Architect/Engineer, and Architect/Engineer has approved rack delivery to site.
   c. Notice has been filed with the Architect, and the Engineer that a 'dust-free' environment has been achieved in the project in all areas where audiovisual system equipment is to be installed. Dust-free shall be defined as follows: all floor, wall, ceiling construction, millwork, finishes (including paint), carpet, hardware, electrical, and HVAC is absolutely complete (and tested and fully operational in the case of electrical and HVAC systems) before AV equipment racks may be delivered to the site.

2. All stationary equipment rack(s) shall be secured to the building structure to meet Seismic and Code Requirements.
3. Great care shall be exercised to keep low level signal lines separated from the AC power lines and high-level signal lines.
4. All audio field lines entering the equipment rack must be connected to equipment. Video field lines may be connected directly to the switcher or patch bays. In the event that a patch bay with an E3 or E90 connectors is used, the patch bay may serve as the terminal block. This will also facilitate the testing of the systems in the Contractor's shop.
5. All connections of lines at terminal blocks, as well as at signal receptacles, shall be mechanically secured and then soldered. No unsoldered connections shall be permitted. Where lines approach the racks and terminal blocks they shall also be mechanically anchored at the rack, and provided with sufficient slack length to avoid strain, abrasion or wear.

F. Wiring and Cabling:

1. Extreme care must be taken to physically segregate and separate all high level lines from lower level lines,
2. Control cables and power distribution wiring shall not be installed adjacent to signal cables. Power distribution cabling shall be on the opposite side from signal wiring in equipment enclosures and shall be uniformly located throughout an installation.
3. All wire and cable utilized in systems interconnection shall be of the flame- retardant type (FR-1 flame test).

G. Penetrations of Cabling in Construction:

1. All cabling or system interconnection which passes through or into acoustically isolated areas, such as sound locks and studios, shall be suitably sealed after cable has been installed.

2. Contractor shall provide all necessary fire stopping of openings through which cable is installed under this Specification in accordance with NFPA 70 and all local Codes. This includes installation in conduits, raceways, or bare penetrations in fire-rated barriers. All Contractor installed “fire stop systems” must be UL approved including fire stop material (Fire Barrier Caulk), which must be UL 1479 approved,

H. Wire Labels:

1. During installation both ends of all wires or cables shall be clearly labeled with approved wire labels.
2. The wire labels shall be numbered consecutively with respect to the patch bay with a leading service level designation. If there are no patch bays utilized in the system the wire labels shall be numbered consecutively with a leading service level designation.
3. The wire labels shall not be more than 8 inches or less than 4 inches from the connector or termination at each end of the cable.
4. Wire labels shall utilize plastic shrink-wrap, protecting the text and ensuring they remain affixed to the wiring. Approved: Thomas and Betts or approved equal, submit sample to the CM's Representative.

I. Documentation:

1. Maintain a careful running log of route and terminations for each cable.
2. A detailed wiring diagram shall be furnished with wire numbers shown as part of the As-Built Documentation. All spare cable shall be shown on the As- Built Documentation.

J. Cable Management:

1. Cables shall be grouped and bundled by type and routed from source to termination in a uniform manner throughout all equipment housings. Care shall be taken not to break the insulation or deform the cable by harness supports. Cables shall not change relative position in a cable group throughout a cable route.
2. Cable support bars shall be installed to support cables in areas of dense harness breakouts such as behind patch panels, distribution amplifiers and other multiple input/output devices.
3. Edge protection material ("cat track") or grommets shall be installed on the edges of holes, lips of ducts or any other point where cables or harnesses cross metallic edges.

K. Terminations:

1. The Contractor shall employ the latest termination practices and materials.
2. Signal and control cable ends shall be neatly formed, and shrinkable tubing shall be applied where necessary to secure the insulation against fraying or raveling.
3. Field terminations shall be made with terminal blocks.
4. Internal rack terminations and field terminations shall be made with terminal blocks.
5. Punch block terminations are not acceptable and shall not be allowed.
6. Coaxial connectors shall be crimp-on and then soldered. Audio and control wires shall be terminated with crimp-on lugs, and then soldered.
7. Digital media cabling — submit proof of applicable cable termination training prior to installation and terminate per Manufacturer’s detailed instructions.
8. All bare wire shall be tinned prior to termination unless the Connector Manufacturer recommends otherwise.
9. Unused line level shields shall be individually insulated using shrinkable tubing and attached to the cable using an additional piece of shrinkable tubing.

L. System Grounding:

1. The "spider" concept is designed to avoid ground loops and inductive coupling.
2. The systems shall be hum free, stable and free of oscillation with the earth ground temporarily disconnected.
3. The earth ground shall be made at only one point in the system as indicated and shall be in accordance with National Electric Code paragraphs 250.146(D), 406.2(D) and 408.20 Exception.
4. The grounding method shall insure that the system is free of the following problems under any mode of operation:

    a. RF oscillation, pickup and interference.
    b. Distortion.
    c. Crosstalk.
    d. Signal Leakage.
    e. Very high frequency feedback.
    f. Audio Hum.

5. Major wiring ducts or trays shall be grounded to the conduit system.
6. The equipment racks shall be isolated from, and not electrically bonded to, the building conduit system. This means that the conduit system shall not be electrically connected to the equipment racks and that the equipment racks shall be installed so that they are electrically isolated from the building structural steel. The racks shall be electrically bonded at only one point to the isolated grounding system as shown on the AV Category Drawings.

M. Seismic Restraints:

1. All hanging or free-standing equipment and cabinets furnished including but not limited to racks, loudspeakers, projection screens, and TV monitors shall be secured to substantial building structures. The equipment described shall resist seismic acceleration in any direction up to a limit of the greater of 1.0 G or the limit prescribed by the Local Governing Codes.
2. Maintain electrical isolation between the equipment racks and building steel.
3. Loudspeaker hanging details, rack bracing, and other seismic restraints are not shown on the Contract Drawings; it shall be the Contractor responsibility to develop these Drawings.
4. Submit loudspeaker mounting (rigging) Drawings to the Architect for review after they have been stamped and signed by a licensed structural engineer engaged in regular practice in the Project's State.

N. Audio System Processing Adjustments:

1. The Contractor shall program the Digital Signal Processing system to include filters adjusted such that the loudspeaker zone(s) effected by same are measured to exhibit uniform (flat) frequency response (less than ±3 dB) at the listening location for the frequencies the transducer is designed/intended to address. Measurements utilized for determining filter adjustments shall be made on axis with respect to a single transducer (representative of the zone) in its intended field of coverage. Loudspeaker cross-over filters shall be provided first for all actively crossed transducers per loudspeaker Manufacturer's instructions. Additional filters will still be required to achieve uniform frequency response measured at the various listening locations. For loudspeaker zones of small transducers, utilize high-pass filters first and foremost and then utilize parametric EQ filters to flatten the measured response. For loudspeaker zones of large transducers, where other transducers in the system will address higher frequencies, utilize low-pass filters first and foremost and then utilize parametric EQ filters to flatten the measured response.
2. The Contractor shall program the Digital Signal Processing system to include delay settings adjusted so that the direct sound from the main loudspeaker clusters and the delay zone transducers in question arrives simultaneously at the listening plane served by the delay zone transducers. The AV Consultant may add additional delay to address 'imaging / Haas affect preferences' as appropriate.

3. The College may add additional filters and delay (as required) to address 'tuning preferences', but such 'tuning preferences' shall not be considered as part of the Base Line Requirements for determining substantial completion of the audio system. Flat frequency response and time alignment of the direct sound from the loudspeakers will be considered a Base Line Requirement for determining substantial completion of the audio system.

O. Loudspeaker Installation:

1. Verify all loudspeaker aiming and positioning with College's Representative.
2. Submit Loudspeaker Mounting (Rigging) Drawings to the Architect for review after they have been approved and signed by a certified Structural Engineer engaged in regular practice in the Project's State.

P. Video Projector Installation:

1. The video projector shall be converged, registered and color balanced, Obtain from the College all scan rates and resolutions that are to be used and properly converge the projector for all possible inputs. In addition, the Contractor shall optimize the projector for the following standard scan rates and resolutions:

a. HDTV, 720p, 1080i and 1080p
b. 1280 x 800, 60Hz, 70Hz, and 75Hz
c. 1440 x 900, 60Hz, 70Hz and 75Hz.
d. 1600 x 1200, 60Hz, 70Hz and 75Hz.
e. 1920 x 1080, 60Hz, 70Hz and 75Hz
f. 1920 x 1200, 60Hz, 70Hz, and 75Hz

3.4 SYSTEM PERFORMANCE TESTS:

A. The Contractor shall pre-assemble and test all systems and sub-systems in his own facility before completed assemblies are delivery to the Project Site.

B. Tests shall include but are not limited to those listed below in order to verify that the system meets all Design Requirements.

C. The Contractor shall perform the initial system testing and adjustment prior to scheduling the final system acceptance tests.

D. All tests shall be fully documented and a neat copy presented for review by the College's Representative and inclusion in the system manual.

1. Performance Tests on Individual Components:
2. Perform in Contractor's facility.
3. Verify that the Manufacturer's Specifications are met.
4. Measure and record the impedance on each driver, and verify the acoustical output and freedom from rattles and distortion of all loudspeakers.

E. Performance Tests on Completed Component Sub-assemblies:

1. Perform in Contractor's facilities.
2. Before delivery of the equipment to the project site, the specialty Contractor shall demonstrate to College's Representatives at the Contractor's facilities that all sub-assemblies are operating as specified.

3. Verify the achievement of the specifications for each electronic component in situ, i.e., as assembled in its console, rack or other enclosure, powered by the system power supply and with all other components also activated, i.e., powered and interconnected. The magnitude and character of the threshold noise shall be observed for appearance of hum in excess of that present with individual activation, or the appearance of high frequency oscillation.
4. Projection equipment shall be tested to verify that the Manufacturer's Specifications are met after it has been incorporated into a complete subassembly.
5. Video equipment shall be tested to verify that its operation meets the Manufacturer's Specifications and EIA RS-170A after assembly into complete subsystems.

F. Performance Tests on the Complete System:

1. Verify that all wiring is correctly and completely installed. Verify that there are no short circuits between conductors within any cable, or from cable to cable. Verify the integrity of each conductor, i.e., that the conductor is not open circuited. In addition, the correct polarity of each connector, including those in patch panels, shall be verified and the color- coding scheme shall be recorded and included in the documentation provided to the College's Representative.
2. Verify that the entire system performance is in accordance with the Design Requirements. Specific attention is directed to the following for each system:

    a. Projection Equipment.
    b. Source Equipment Transports
    c. Video Matrix Switchers.
    d. Remote Control Components.
    e. Video Distribution Amplifiers.
    f. Audio Amplifiers.
    g. Consoles.
    h. Networking Equipment.

G. The threshold noise output of the system, measured at the output of the power amplifier, must equal the input when its gain control is full on, and of the line or booster amplifier input when all channel controls are off. No hum shall be audible in the system within the noise signal, or with the inputs terminated in microphone impedance and all controls full on. No high frequency oscillation shall be observed at the system output. No audible radio signal shall be detectable in the system at any control setting. Depending upon the proximity of a local radio station or upon the cable configuration of the system, RF oscillation or leakage may be a problem and the Contractor shall be prepared to install a RF low pass filter appropriately in the system as a final remedy.

H. Cross talk between channels shall be measured with signal equivalent to 1.0 Volts output into one channel with its gain off and the gain of each other channel varied over their full range. Maximum signal leakage at the system output must be equivalent to -70 dB re 1.0 Volt at the pre-amp output at 1 kHz, increasing to -52 dB at 8 kHz.

I. The general performance of each loudspeaker unit in situ shall be verified by applying pink noise signal at 10.0 Volt level and verifying the specified output SPL at a distance of 1 foot. Normal undistorted sound quality shall be verified by headphone listening at the output of the calibrated system. Each loudspeaker shall also be fed with an oscillator signal at 10.0 volt level within its intended frequency range, verifying absence or abnormal distortion of rattles due to installation.

J. The audio system shall be adjusted as specified above entitled “Audio System Processing Adjustments" where Minimum Requirements for establishing readiness for the substantial completion observation of an audio system are specified.

K. The complete video system shall be tested in the following manner: All video outputs of the system shall conform to EIA RS-170A when typical inputs to the system are fed with a “known good signal" from a video signal generator.

L. Provide installation functionality test results report prior to substantial completion punch walk.

M. Test procedures for video systems shall conform to the following Basic Guidelines:

1. All equipment and video signal chains shall operate according to Manufacturer's Specifications and/or to the EIA RS-170A Standard.

    a. Black level (using the brightness control).
    b. White level (using the contrast control).
    c. Correct Hue.

2. All video cameras shall be setup and adjusted for the following:

    a. Black balance.
    b. White balance.
    c. Range of zoom and iris function.

N. All these tests, and any others that the Contractor may wish for his own satisfaction, shall have been performed and successfully achieved before observation requested. The College's Representative may request repetition and demonstration during observation of certain of these tests or other critical tests if problems become apparent. If Specifications are not met, further observations will be at the Contractor's expense.

3.5 DEMONSTRATION AND ACCEPTANCE TESTING

A. Substantial Completion Observation:

1. The Contractor shall file a written notice with the College when all of the aids to use describe in “Submittals”, above, have been submitted for approval, all tests described in above in “System Performance Tests”, are complete and the test reports have been submitted for review and approval and the systems and sub-systems are ready for the Substantial Completion Observation.
2. The Contractor shall be prepared to demonstrate the overall system performance including but not limited to functionality, control system programming, operation, optics performance and Digital Signal Processing software control (where applicable). The Contractor shall be prepared to demonstrate proper gain structure and that base line EQ (equalization of uniform frequency response) settings and delay filters (time alignment) have been set. In addition the Substantial Completion Observation of the systems may include repetition or demonstration of any or all of the tests described in “System Performance Tests” above or other critical tests if problems become apparent and the Specifications are not met. After the Substantial Completion Observation, written notice noting whether the systems meet the criteria set forth in the General Conditions for Substantial Completion, along with a list of items for the Contractor to correct shall be provided to the Contractor.
3. In the event that the systems are found not to be Substantially Complete, all of the costs including fees, travel and living expenses in connection with subsequent observations or corrective work shall be borne solely by the Contractor. This includes new problems that arise during the course of the subsequent observations.

B. Acceptance Observation:

1. After the systems have been certified as Substantially Complete, and the Contractor has filed written notice with the College that the corrections ordered, have been completed, a Final Acceptance Observation shall be scheduled.
2. During the Final Acceptance Observation of the systems repetition or demonstration of any of the tests described in “System Performance Tests”, above, or other critical tests if problems become apparent and the Specifications are not met, may be requested.
3. Assist in performing final system adjustments and acceptance tests. Provide all labor, materials and tools necessary for these tests and adjustments. Provide all necessary test equipment to complete the tests.
4. Budget 24 working hours for the performance of these tests and adjustments with the College’s Representative. If final acceptance is delayed beyond this period because the installation is not in proper working order or is incomplete, the Contractor shall pay for all additional time and expenses for any resultant extension or re-scheduling of the acceptance testing period.
5. Any measurements of frequency response, distortion, noise or other characteristics and any adjustments deemed necessary may be performed on any item or group of items, including re-orientation of loudspeakers, to insure optimum performance of the system.
6. In the event that the corrections have not been completed to the satisfaction of the College 's Representative, or new problems arise at the time of the Acceptance Observation, all costs including consulting fees, travel and living expenses in connection with subsequent observations or corrective work shall be borne solely by the Contractor.

C. Acceptance:

1. After observations and tests indicate that the entire AV system and sub systems as specified herein and indicated on the Drawings are in total compliance with the Drawings and Specifications, a letter indicating said compliance shall be issued.
2. Acceptance of the system shall be accomplished as described in the General Conditions.
3. Final acceptance of the installation will be granted when it is clear to the College's Representative and the architect that the following conditions have been met:

    a. All fixed equipment has been furnished and installed according to the Drawings and Specifications.
    b. All portable equipment has been turned over to the College.
    c. All equipment and installation have been tested and shown to perform as specified.
    d. All instruction manuals, software source Code and As-Built Documentation have been completed and delivered to the College's Representative.

4. The Warranty period will begin only when all of the above listed items have been performed to the satisfaction of the Architect, Engineer and College's Representative.

D. Training

1. Submit all training materials to the College's Representative for approval prior to scheduling training sessions.
2. Provide 24 hours of hands on training practical operation of the system to the College 's Representative. Address in the training, the general configuration of the system, basic functionality, correct operation procedures, routine maintenance and upkeep.
3. Provide 4 hours of follow-up training within 3 months of the initial training to review aspects of the original training and provide instruction on specific troubleshooting issues the College’s Representative raises during the training,

4. Record via video and audio all training sessions and provide 3 copies to the College on DVD- R format.

END OF SECTION 274116
040119/212227

SECTION 275126 - ASSISTIVE LISTENING SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances tools, equipment, facilities transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other Sections for work related to those other Sections and required to be included as work under this Section.
2. General Provisions and Requirements for electrical work.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

Submit block wiring diagrams and catalog data showing component interconnection and descriptive literature for all component parts and cabinets.

1.3 EQUIPMENT QUALIFICATION

A. All Equipment shall conform to Federal, State and Local applicable Codes, Ordinances and AHJ, and shall be listed and labeled by Underwriters Laboratories.

B. Assistive-Listening Systems

1. Assistive-listening systems shall be provided in accordance with CBC Section 11B-219 and shall comply with CBC Section 11B-706.
2. The minimum number of receivers to be provided shall be equal to 4% of the total number of seats, but in no case less than two. 25% minimum of the receivers provided, but no less than two shall be hearing-aid compatible in accordance with CBC Section 11B-706.3.
3. If the system provided is limited to specific areas or seats, then such areas or seats shall be within a 50-foot viewing distance of, and have a complete view of, the stage or playing area. CBC Section 11B-219.4.

PART 2 - PRODUCTS

2.1 GENERAL

A. The Assistive Listening System shall include the following items

1. Instructor (program source) wireless transmitter units.
2. Student (audience) portable wireless receiver units.
3. Plug-in microphones and earphones, for each unit.

4. Multiple program source inputs for, Instructor's microphone, respective room audio/video A/V system input/output and Instructor's computer audio input/ output.
5. System accessories.

B. Function

1. The Assistive Listening System shall provide amplified available audio programs for hearing impaired students/audience, originating from classroom/stage/room instructors and audio/video instructional program source materials, and equipment in respective building spaces, rooms, classrooms and outdoor areas.
2. The audible program shall be transmitted wireless from the program source to the student/audience, with reception coverage throughout not less than approximately 80% of the respective floor space/area space.
3. Shall provide automatic stereo or mono audio full system operation, depending on program source input.
4. The system in each space shall comply with Federal ADA, State and Local AHJ Requirements for the hearing impaired.

2.2 MATERIALS (RF WIRELESS)

A. General

1. Power for each portable unit operation shall be supplied by internal, changeable rechargeable NiCad batteries and alternately by alkaline disposable batteries. Rechargeable batteries shall be recharged without removal from the unit. Each unit shall have a charging indicator light. The batteries shall be recharged from either a portable charger/organizer and with wall transformer/two unit chargers. The units shall operate for up to 40-hours with alkaline batteries, and up to 10-hours with NiCad (NiMH) batteries. The batteries shall be rechargeable without removal from unit.
2. Provide power on-off control on each unit, to extend battery duration.
3. A protection circuit shall prevent battery "back-drain" if the power to the charger is turned off while the unit is being recharged.
4. The receivers and transmitters shall be US Government FCC and Industry Canada-approved, for FM-RF (radio frequency) wireless operation.
5. All components shall be the product of the same Manufacturer.
6. As manufactured by Williams Sound; or PhonicEar; or Listen Technologies; or Centrum Sound.

B. Instructors Portable (Program Source) RF Transmitter Units

1. The transmitter, shall be compact, easily portable units, self-contained ABS, plastic housing/enclosure shall clip to a pocket or belt.
2. Each portable transmitter shall provide RF transmitting on one of the US Government 40 different FCC – and Industry Canada-approved narrow-band channels in the 72-86MHz RF band.

    a. Line-of-sight transmit-distance range of not less than 100-feet up to 150-feet from transmitter to receiver.

3. Easy-to-read channel label and volume adjustment on the front unit face. Stereo and mono audio processing.
4. 3.5mm auxiliary input jack that allows transmission of audio from an auxiliary source such as a cassette recorder, computer, CD/DVD player or television audio source. The transmitter shall also provide a second 3.5mm microphone input source jack. The two input sources shall be simultaneously operational to provide a mixed signal output RF transmission of the two sources.

5. Select the separate independent RF transmission frequency for each transmitter to prevent transmission interference between units and to provide for at least two student receiver units to selectively overlap reception of the transmitter.
6. Quantity of Instructor's portable RF transmitters

    a. Provide quantity of nine instructor portable transmitters, 3-on low band; 3-on mid band and 3-on high band RF frequencies.
    b. Provide a quantity of one portable transmitter at the respective room audio/video (A/V) equipment, program output source. Provide 120 volt AC-to-DC power-supply for portable transmitter at the A/V equipment location.

7. Extended range fixed base non-portable RF transmitter.

    a. Provide fixed location non-portable base unit RF transmitter for spaces larger than 9,000 square foot indoor or outdoor spaces.
    b. Shall have the same RF characteristics and performance as the portable transmitter except as follows:

        1) Line-of-sight transmit-distance range of not less than 800-feet from transmitter to receiver.
        2) Fixed install location non-portable, with NEMA-1 metal housing.
        3) Radiated RF energy intensity shall provide manual attenuation adjustments to prevent multiple adjacency RF interferences.

    c. Provide a student/audience portable RF receiver unit at the RF base unit to receive RF signals from an instructors RF transmitter. Connect to the base unit to rebroadcast. Provide a self-contained 120-volt AC-to-DC power-supply for the portable receiver at the base unit transmitter.
    d. Shall operate on 120 volt 60Hz AC branch circuit. Provide remote system master on-off control.
    e. Provide remote RF antenna (outdoor/indoor) rated, for fixed base RF transmitter. Antenna shall extend the transmitter range for large spaces. Provide two RG-6 coaxial cable connects from antenna to base transmitter.

C. Student/Audience Receiver Units

1. The multi-channel narrow-band FM receivers shall be compact easily portable units, self-contained ABS/plastic housing/enclosure and shall clip to a pocket or belt.
2. The receiver shall provide an on/off switch and volume control which adjusts the output level as required by the listener.
3. The receiver shall have a 3.5mm output jack which accepts one of any of the plug-in listening accessories. Headsets shall provide magnetic induction pick-up for hearing impaired, hearing aid interface operation.
4. The receiver shall have an easy-to-read channel label on the front face. The receiver shall incorporate an automatic squelch circuit which eliminates white noise when the receiver is out of transmission range. Stereo and mono audio reception and processing.
5. The multi-channel receiver shall receive any six of the US Government forty different FCC- approved narrow-band FM frequencies within the 72-76MHz band from the respective transmitter units. The user shall be able to change to any one of these six frequencies by using a slide or rotary switch on the receiver. Label on the front face shall indicate the receiver is a multi-channel unit. A label inside the battery compartment shall indicate the six channels that are available to the user.

6. Quantity of portable RF receivers

a. Provide a quantity of two receivers with matching frequencies for each transmitter, not less than eighteen total quantities of receivers.
b. Provide a quantity of one receiver with matching RF frequency of the transmitter at the respective room audio/video (A/V) equipment, program input source. Provide 120 volt AC-to-DC power-supply for portable receiver at the A/V equipment location.
c. Provide hearing aid compatible units at a ratio of one per four receivers in accordance with ADA 219.3.

D. RF System Accessories

1. Battery recharger portable charger/organizer pack.

   Locking, portable case with cover, shall accept a group of not less than twelve plug-in portable transmitter and receiver units in each pack for simultaneous multi-unit battery recharging. Provide a quantity of one organizer for each quantity group of twelve (or fraction thereof) transmitters receivers provided as part of the Contract.

2. Stereo audio headset style automatic noise canceling microphone, integral on-off-volume control and with behind the neck support style each with cable and outlet plug-jacks to match transmitter jacks. Provide two cables for each transmitter.
3. Equipment wall mount support brackets.
4. Auxiliary audio program source 15-feet long cables with plug-in at both ends to match transmitter jacks. Provide two for each transmitter.
5. Stereo audio headset style ear phones with cable and plug to match receiver jacks. Headsets shall provide magnetic induction pick-up for hearing impaired, hearing aid interface operation. Provide one headset for each receiver.
6. Rechargeable Ni-Cad (NiMH) batteries, one complete set for each transmitter and receiver unit.
7. Locking auxiliary equipment storage cases for cables, microphones and headsets, with quantity and capacity for all auxiliary accessories furnished as part of the Contract.

2.3 MATERIAL (INFRARED WIRELESS)

A. General

1. All equipment shall be the product of the same Manufacturer.
2. The receivers and transmitters shall be US Government FCC and Industry Canada-approved.
3. Provide power on-off control on each unit, to extend battery duration.
4. As manufactured by Williams Sound; or PhonicEar; or Listen Technologies; or Centrum Sound.

B. Master (Program Source) Transmitter (Infrared Emitter) Units

1. The infrared emitter/transmitter shall be compact, portable units, self-contained ABS/plastic housing/ enclosure.
2. The emitter panel shall be a dual-channel system operating on both 2.3 and 2.8MHz invisible infrared light waves' frequencies. The channels shall be designated "CHANNEL A" for the left and "CHANNEL B" for the right.
3. The emitter shall provide left and right AUDIO IN jacks to accept an input signal from a sound system, left and right "SYNC IN/SYNC OUT" jacks for master/slave daisy-chaining with other emitters if desired, and left and right "MIC-IN" jacks to accept an audio signal from a microphone or Audio/ Video preamplifier.
4. The emitter shall provide separate LED input level detectors for each channel which illuminate when the audio signal peaks. Stereo and mono audio processing.

5. The emitter shall be mounted by the following methods:

    a. Fixed to a wall with an adjustable, wall-mounting support bracket accessory.
    b. Portable mounted to a table-top-or floor-stand, using accessory support-stand adapter.

6. Each emitter shall provide an array of not less than 130-infrared LEDs covered by an infrared transparent acrylic lens. The infrared signal from each emitter shall cover not less than 3,000 square feet (32,000 cubic feet) enclosed space. Note: For room sizes smaller than 3000 square feet, the infrared transmitter/emitter infrared output shall be reduced to accommodate the actual smaller room square feet size and height.
7. 120 volt 60Hz AC input to nominal 24-volt DC output (plug-in "power-brick") power supply external transformer shall be UL approved, with cable "plug-in" connection to emitter/transmitter. Provide remote system master on-off control.
8. Slave emitter/transmitter for rooms exceeding 30,000 cubic feet. Provide one additional infrared emitter/transmitter repeater slave unit, for each additional 30,000 cubic feet room volume, or fraction thereof. The slave repeater shall receive and retransmit the program signals from the master unit. Provide one 100-foot long "master-to-slave" auxiliary portable extension wire cable for each slave unit.
9. Provide wall mount plug-in outlets for instructors' microphone outlet connect ports to emitter/ transmitter.

    a. Provide 1.0-inch conduit and wire, homerun connect from microphone outlet to each room respective emitter/transmitter and slaves. Provide conductors as recommended by Manufacturer.
    b. Provide 1.0-inch conduit and wire homerun connect from microphone outlet to respective room Audio/Video (A/V) equipment, microphone program source input. Provide conductors as recommended by Manufacturer.

10. Provide a quantity of nine emitter/transmitter "master" units, plus additional "slave" units for adjusted room sizes.

C. Student/Audience Receiver Units

1. Battery Power

    a. Power for each unit operation shall be supplied by internal, changeable rechargeable NiCad batteries and alternately by alkaline disposable batteries. Rechargeable batteries shall be recharged without removal from the unit. Each unit shall have a charging indicator light. The batteries shall be recharged from either a portable charger/organizer and with wall transformer / two unit chargers. The units shall operate for up to 40-hours with alkaline batteries, and up to 15-hours with NiCad (NiMH) batteries.
    b. Provide power on-off control on each unit, to extend battery duration.
    c. A protection circuit shall prevent battery "back-drain" if the power to the charger is turned off while the unit is being recharged.

2. The receiver shall be a dual-channel unit for wearing around the neck with an adjustable strap. Stereo and mono audio reception and processing.
3. Compatible with the transmitter (emitter) and operate on 2.3MHz and 2.8MHz frequencies invisible infrared light waves. Self-contained and switchable from "CHANNEL A" to "CHANNEL B" through a switch located on the back of the unit.
4. The receiver shall provide an infrared light-gathering lens on the front of the unit to focus the light signal from the emitter onto the infrared detector element. The receiver shall detect and decode the infrared emitter/transmitter light source within a 160° acceptance angle.

5. Audio squelch circuit which turns the output circuit off when the infrared signal is reduced or not received, with on/off and volume control.
6. Output jack, which accepts any of the listening accessories. Headsets shall provide magnetic induction pick-up for hearing impaired, hearing aid interface operation.
7. Shall be compact easily portable units, self-contained ABS/plastic housing/ enclosure with red infrared receiver lens. Shall clip to pocket or belt.
8. Provide quantity of two infrared receivers for each master transmitter, not less than eighteen total quantities of receivers.

D. Infrared System Accessories

1. Battery recharger portable charger/organizer pack.

   Locking, portable case with cover, shall accept a group of not less than twelve plug-in portable transmitters and receivers units in each pack for simultaneous multi-unit battery recharging. Provide a quantity of one organizer for each quantity group of twelve (or fraction thereof) receivers provided as part of the Contract.

2. Stereo audio headset style automatic noise canceling microphones, integral on-off-volume control and with behind the neck support style. Each with 25-feet long extension cables and outlet plug-jacks to match transmitter outlet jacks. Provide two cables for each emitter/transmitter.
3. Equipment wall mount support brackets.
4. Auxiliary audio program source 15-feet long cables with plug-in at both ends to match transmitter jacks. Provide two for each transmitter.
5. Headset style ear phones with cable and plug to match receiver jacks. Headsets shall provide magnetic induction pick-up for hearing impaired, hearing aid interface operation. Provide one headset for each receiver.
6. Rechargeable Ni-Cad (NiMH) batteries, one complete set for each unit.
7. Locking auxiliary equipment storage cases for cables, microphones and headsets. Quantity and capacity as required to store all accessories.
8. Portable floor stand, for infrared emitter/transmitter units mounting and support, with variable height adjustment and tip-resistant weighted base. Provide one floor stand for each infrared emitter/ transmitter.
9. Locking, portable case for infrared emitter/transmitter. One for each emitter/ transmitter unit.
10. Provide microphone extension cable with plug to match microphone and infrared emitter/transmitter microphone input jack, 25-feet length. One for each microphone.

PART 3 - EXECUTION

3.01 GENERAL

A. Each System General

1. Assemble, set up, and test each transmitter, receiver, and accessories units.
2. Install and fully charge all batteries prior to and after testing/set up is complete.

B. Wireless RF Units

1. Perform an onsite RF frequency survey to determine available unused RF channels, prior to selecting unit operating channels and prior to ordering the equipment.
2. Select operational RF frequency to prevent system RF interference's with other equipment.
3. Provide - one 0.75-inch conduit with two Category–6, ANSI/EIA/TIA-568C 4-pair, UTP cables connecting from each emitter/transmitter master outlet box location to respective room instructors microphone outlet box location. Provide matching RJ-45 Category-6 female jacks at each outlet box for each cable. Provide an audio circuit matching Balun at each outlet RJ-45 jack location, for RJ-45-to-portable cable plug-in transition and circuit impedance matching audio/transformer, into respective equipment. Additionally provide four Portable Category-6 patch cables with RJ-45 jacks on each end of 7-foot long patch cable. Typical for each outlet location.

C. Wireless Infrared Units

1. Provide aiming and intensity adjustments of emitter/transmitter units to insure complete room coverage.
2. Provide - one 0.75-inch conduit with two Category–6, ANSI/EIA/TIA-568C 4-pair, UTP cables connecting from each emitter/transmitter master outlet box location to respective room instructors microphone outlet box location. Provide matching RJ-45 Category-6 female jacks at each outlet box for each cable. Provide an audio circuit matching Balun at each outlet RJ-45 jack location, for RJ-45-to-portable cable plug-in transition and circuit impedance matching audio/transformer, into respective equipment. Additionally provide four portable Category-6 patch cables with RJ-45 jacks on each end of 7-foot long patch cable. Typical for each outlet location.
3. Provide - one 0.75-inch conduit with two Category–6, ANSI/EIA/TIA – 568C, 4-pair UTP cables connecting from each emitter/transmitter master outlet box location to respective room audio amplifier / preamplifier location. Provide matching RJ-45 Category-6 female jacks at each outlet box location for each UTP cable. Provide an audio circuit matching Balun at each outlet RJ-45 jack location, for RJ-45-to-portable cable plug-in transition and circuit impedance matching audio/transformer, into respective equipment. Additionally provide four portable Category-6 patch cables with RJ-45 jacks on each end of 7-foot long patch cable. Typical for each outlet location.

END OF SECTION 275126
040119/212227

[BLANK PAGE]

SECTION 275313 - CLOCK SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances tools, equipment, facilities transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other Sections for work related to those other Sections and required to be included as work under this Section.
2. General Provisions and Requirements for electrical work.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Submit product data sheets and descriptive literature for all component parts.

B. Submit block wiring diagram of the clock and paging systems, showing headend equipment, terminal cabinets, remote power supplies, and typical clock for each zone.

1.3 EQUIPMENT QUALIFICATION

A. The Specification is based on the equipment of Manufacturers who have been approved by the District and the Manufacturers herein named shall be considered as meeting the Requirements of this Specification. For all items which are identified by part number and Manufacturer the Performance Specifications which are published in the most recent Manufacturer's data sheets available at the time of bidding this Project shall be applicable to the present work as though fully written out herein.

B. All equipment shall conform to all local applicable Codes and Ordinances, and shall be listed by Underwriters Laboratories.

1.4 QUALIFICATIONS

To qualify as an acceptable Bidder, whether the bid is submitted to the District, his Agent, a General Contractor or a Sub-Contractor, the System Bidder or Contractor shall be qualified Sound Contractor and shall hold a valid C61 License issued by the Contractors State License Board of California. The System Bidder or Contractor shall hereinafter be referred to as the Contractor. The Contractor shall hold all other licenses required by the legally constituted Authorities Having Jurisdiction (AHJ) over the work. The Contractor shall be the Factory Authorized Distributor for the brand of equipment offered and shall have been engaged in the business of supplying and installing the specified type of system for at least 5-years. The Contractor shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment.

1.5 GENERAL REQUIREMENTS AND SCOPE

A. Furnish and Install a complete new GPS wireless clock system using Primex Wireless Inc. GPS wireless system or equal by American Time and Signal, Sapling. All bids shall be based on the equipment as specified herein.

B. Section includes Transmission Systems GPS Receiver, Primary Transmitter, and Satellite Transmitter.

1. Clocks:

a. Analog
b. Digital

1.6 RELATED SECTIONS

Division 26 – Electrical (120 volt grounded outlet required for transmitter).

1.7 REFERENCES

This Technical Specification and Associated Drawings, Primex Wireless GPS Satellite Time System User Manual.

1.8 DEFINITIONS

GPS: Global Positioning System, a worldwide system that employs 24-satellites in an integrated network to determine geographic location anywhere in the world, and which employs and transmits Universal Coordinated Time, the world's most accurate and reliable time.

1.9 SYSTEM DESCRIPTION

A. GPS wireless clock system shall continually synchronize clocks throughout the facility, and shall be capable of clock readouts in multiple time zones where desired.

B. The system shall provide wireless time using GPS and be synchronized to UTC. The system shall not require hard wiring. Clocks shall automatically adjust for Daylight Saving Time

C. Analog Clocks shall be synchronized to within 10-milliseconds 6-times per day, and the system shall have an internal oscillator that maintains plus or minus 1-second per day between synchronizations, so that clock accuracy shall not exceed plus or minus 0.2 seconds.

D. The system shall include an internal clock reference so that failure of the GPS signal shall not cause the clocks to fail in indicating time.

E. The system shall incorporate a "fail-safe" design so that failure of any component shall not cause failure of the system. Upon restoration of power or repair of failed component, the system shall resume normal operation without the need to reset the system or any component thereof.

F. Clock locations shall be as indicated, and clocks shall be fully portable, capable of being relocated at any time.

G. The system must operate in accordance with a "Radio Station Authorization", Form FCC 601 – LM, granted by the Federal Communications Commission (FCC). This license will be issued to and held by the end user.

1.10 REGULATORY REQUIREMENTS

A. Equipment and components furnished shall be of Manufacturer's latest model.

B. The end user will hold a License, known as a "Radio Station Authorization" granted by the FCC.

1. This License grants the end user protected use for wireless transmission at the designated frequency.

2. This License will designate a unique "call sign" for each end user.

C. Transmitter and Receiver shall comply with Part 90 of FCC rules as follows:

1. This device may not cause harmful interference, and
2. This device must accept interference received, including interference that may cause undesired operation.
3. Transmitter frequency shall be Governed by FCC Part 90.35.
4. Transmitter output power shall be Governed by FCC Part 90 257 (b)

D. System shall be installed in compliance with Local and State Authorities Having Jurisdiction.

E. Operating License: Submit evidence of application for FCC Radio Station Authorization prior to installing equipment. Furnish the license or a copy of the application for the license, to the District/End User prior to operating the equipment. The original license must be delivered to the District/End User.

F. Samples: Submit one clock for approval. Approved sample shall be tagged and shall be installed in the work at location directed.

G. Manufacturer's Instructions: Submit complete installation, set-up and maintenance instructions.

H. Floor Plans indicating the location of system transmitter(s), approved by Manufacturer, will be submitted to District prior to installation.

1.11 QUALITY ASSURANCE

A. Permits: Obtain Operating License for the transmitter from the FCC.

1. Qualifications:

a. Manufacturer: Company specializing in manufacturing commercial time system products with a minimum of 30 continuous years of documented experience including 4 years' experience producing GPS wireless time systems.
b. Installer: Company with documented experience in the installation of commercial time systems.

2. Prior to installation, a site survey must be performed to determine proper transmitter placement.

1.12 DELIVERY STORAGE AND HANDLING

A. Deliver all components to the site in the Manufacturer's original packaging. Packaging shall contain Manufacturer's name and address, product identification number, and other related information.

B. Store equipment in finished building, unopened containers until ready for installation.

1.13 PROJECT SITE CONDITIONS

A. Clocks shall not be installed until painting and other finish work in each room is complete.

B. Coordinate installation of GPS receiver for access to the roof or exterior side wall so that the bracket and related fasteners are watertight.

1.14 SYSTEM STARTUP

At completion of installation and prior to final acceptance, turn on the equipment; ensure that all equipment is operating properly, and that all clocks are functioning.

1.15 WARRANTY

Manufacturer will provide a 1-year warranty on GPS receiver, transmitter, and satellite transmitter. All other components will have a 1-year warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURER

GPS wireless clock system shall be manufactured by Primex Wireless, Inc., N3211 County Road H, Lake Geneva WI 53147, telephone (800) 537-0464, Fax (262) 248-0061, www.primexwireless.com or equal by American Time and Signal, Sapling.

2.2 SEQUENCE OF OPERATION

A. Transmitter Operation: When power is first applied to the transmitter, it checks for and displays the software version. It then checks the position of the switches and stores their position in memory. The transmitter looks for the GPS time signal. Once the transmitter has received the GPS time, it sets its internal clock to that time. The transmitter then starts to transmit its internal time once every second. The transmitter updates its internal clock every time it receives valid time data from the GPS.

B. Analog Clock Operation:

1. Apply power or insert batteries. Follow set up procedures detailed in Manufacturer’s instructions.
2. After initial setup, the clock will shut off the receiver. Six times each day, the microprocessor will activate the receiver and starting with the stored channel, it will again look for a valid time signal. If necessary, the clocks will resynchronize to the correct time.

3. If the clock has not decoded a valid time signal for a pre-determined number of days, it will go to a step mode. Non signal reception can be caused by low battery voltage. If this occurs, replace the batteries.

2.3 EQUIPMENT

A. General: The clock system shall include a transmitter, a roof or window mounted GPS receiver, indicating clocks, and all accessories for complete operation.

B. The GPS Receiver shall be a complete GPS receiver including antenna in a waterproof case, designed for roof or outdoor mounting. Provide mounting bracket for attachment to roof structure.

C. The GPS Receiver cable must be plenum rated where required by local Code.

D. Transmitter: Primex Wireless Model 14400, consisting of wireless transmitter with GPS receiver, a surge protection device/battery backup, and a mounting shelf. Unit shall obtain current atomic time from satellite. The clock system shall transmit time continuously to all clocks in the system.

1. Transmission:

a.	Frequency Range:	72.100 to 72.400 MHz.
b.	Transmission Power:	1 watt (30dBm) maximum
c.	Radio technology:	narrow band FM
d.	Number of channels:	16
e.	Channel bandwidth:	20kHz maximum
f.	Transition mode:	one-way communication
g.	Data rate:	2 KBps
h.	Operating range:	32 degree F to 158 degrees F (0 degrees C. to 70 degrees C).

2. Transmitter:

a.	Transmitter output power:	+26 to +30 dBm
b.	Frequency deviation:	+/- 4 kHz
c.	Transmitter Power Requirements:	120 VAC 60 Hz
d.	Internal Power Requirements:	5 VDC
e.	Carrier frequency stability:	+/- 20 ppm

3. Transmitter shall have 16 selectable channels to assure interference-free reception.
4. Transmitter shall have the following switches:

a. Time zone adjustment switches for all time zones in the World. Includes Eastern, Central, Mountain, Pacific, Alaska, and Hawaii.
b. Daylight Saving Time bypass switch.
c. 12-hours or 24-hours display.

5. Transmitter housing shall be black metal case, 16¾-inches (424.4mm) by 12 inches (304.8mm) by 1-7/8 inches (46.4mm) in size.
6. Antenna shall be 46-inches (1168mm) high, commercial type, mounted on top center of transmitter housing. Antenna gain shall be < 2.2 dB. Antenna polarization shall be vertical.

7. Transmitter housing shall incorporate a display which shall include the following:

a. Time readout
b. AM and PM indicator if 12-hour time display is set
c. Day and date readout
d. Indicator for daylight savings or standard time
e. LED which shall flash red in event of reception problem
f. GPS reception indicator

8. Transmitter shall contain an internal clock such that failure of reception from the GPS will not disable the operation of the clocks.
9. Power supply (included):

a. Input: 120 volt AC 50/60 Hz, 0.4 amps.
b. Output: 9 volt DC, 1.5 amps.

E. Surge Protector/Battery Backup (included).

1. Input: 120 volt AC 60 Hz +/- 1 Hz.
2. Output: 120 volt AC, 500VA, 300 watts
3. Surge Energy Rating: 365 joules

F. Additional Equipment

1. Wireless Receiver Switches: Switches shall receive time packets from the Primary Transmitter and relay the synchronized time to the Satellite Transmitter connected to it. The unit shall include the following:

a. Antenna mounted on top of the switch housing, 11½-inches (292mm) long. Power Supply:

1) Input 120 VAC 50/60Hz, 0.4 amps
2) Output: 9 volt DC, 1.5 amps RS 232 data cable, 5 feet (1.5mm) long

b. Daylight Savings Time bypass switch
c. Dimensions: 4¼-inches (108mm) long, 5¾-inches (146mm) wide, 1¼-inches (31.75mm) deep.
d. Weight: 12 ounces (.34kg)
e. Operating Range: 32 degrees F to 158 degrees F (0 to 70 degrees C)

2. Satellite Transmitters Primex Wireless Model 14401: Satellite Transmitters shall receive the signal from the Wireless Receiver Switches and transmit the signal to the devices in its vicinity, which are out of the range from the Master Transmitter. The unit shall include the following:

a. Antenna mounted on top of the housing, 46 inches (1168mm) long.
b. Wireless Receiver Switch.
c. Power Supply Input: 120
d. VAC, 50/60Hz, 0.4-amps
e. Output: 9 volt DC, 1.5-amps.
f. 6 foot (1.83m) cord
g. Surge Suppressor/Battery Backup
h. Mounting Shelf.
i. Transmission Power: 1 watt maximum
j. 72 MHz frequency.

3. Traditional analog clocks (battery): Analog clocks shall be wall mounted. Clocks shall have poly-carbonate frame and polycarbonate lens. Face shall be white. Hour and minute hands shall be black.

a. 9 inches (228.6mm) diameter analog clock: Primex Wireless Model 14280
b. 12½-inch (317.5mm) diameter analog clock: Primex Wireless Model 14155
c. 16 inches (406.4mm) diameter analog clock: Primex Wireless Model 14163
d. 24 inches (610mm) diameter analog clock: Primex Wireless Model 14346

4. Additional colors, finishes, and dial faces are available from Manufacturer.

a. Analog clocks shall be battery-operated,
b. Analog clocks shall be capable of automatically adjusting for Daylight Saving Time. An on-off switch located on the transmitter shall disable this function if desired.
c. Time shall be automatically updated from the transmitter 6 times per day.
d. Analog clocks shall remember the time during changing of batteries.
e. 9 inches (228.6mm) and 12.5 inches (317.5mm) analog clocks shall have a tamper proof/ theft resistant clock lock mounting slots.

5. Analog clock receivers shall be as follows:

a. Receiver sensitivity: >-110 dBm
b. Receiver power: 24 VAC or 120 VAC (see model #)
c. Antenna type: internal
d. Antenna gain: -7 dBd

If transmitter stops transmitting valid time signals due to power failure, the clocks will continue to function as accurate quartz clocks until a valid time signal is decoded. If signal transmission is not restored after 96 hours, the second-hand will “five-step” as a visual indicator that the signal has been lost. Should the clocks lose power and signal, the clocks will not function.

6. Wire guards: Provide one for each analog clock as follows:

a. Analog clock wire guard Primex Wireless Model 14131, 14-inches by 14-inches (355.6 by 355.6 mm) size, for nominal 12½-inch (317.5 mm) diameter analog clocks.
b. Analog clock wire guard Primex Wireless Model 14123, 18-inches by 18-inches (457.2 by 457.2mm) size, for 16 inches (406.4mm) diameter analog clocks.

7. Cable Connection Sealant: Radio Shack Coaxial Cable Connector Sealant 278-1645, or approved electrical grade silicone sealant.

PART 3 - EXECUTION

3. 1 EXAMINATION

A. Verify that construction is complete in spaces to receive equipment and that rooms are clean and dry.

B. Verify that 120-volt electrical outlet is located within 6 feet (1.83m) of location of transmitter and the outlet is operational and properly grounded.

3.2 INSTALLATION

A. Provide all equipment necessary for a complete and operable system.

B. Transmitter: Locate transmitter where indicated, a minimum of 2 to 3 feet (.6 to 1 meter) above the floor, away from large metal objects such as filing cabinets, lockers or metal framed walls. Transmitter(s) will be placed at locations indicated below:

1. Attach receiver to transmitter using cable.
2. Connect antenna to transmitter, using care not to strip threads.
3. Connect power supply to the transmitter. Set the channel number on the display to correspond to the FCC license.
4. Plug power supply into electrical outlet.

C. Analog clocks shall perform the following operations with each clock:

1. Set clock to correct time in accordance with Manufacturer's instructions.
2. Observe analog clock until valid signals are received and analog clock adjusts itself to correct time.
3. Install the analog clock on the wall in the indicated location, plumb, level and tight against the wall. If using 12½-inch (317.5mm) clock, attach using clock-lock hanging method and suitable fasteners as approved by Clock Manufacturer.
4. Wire guards: Secure to wall, using approved theft-resistant fasteners.

3.3 ADJUSTING

Prior to final acceptance, inspect each clock, adjust as required, and replace parts which are found defective.

3.4 CLEANING

Prior to final acceptance, clean exposed surfaces of clocks, using cleaning methods recommended by Clock Manufacturer. Remove temporary labels from clock faces. Do not remove labels from backs of clocks.

3.5 DEMONSTRATION

Provide training to District's Representative on setting and adjusting clocks, replacing batteries and routine maintenance.

3.6 PROTECTION

Protect finished installation until final acceptance of the Project.

3.7 TESTING

All devices must be tested at their operational location under normal operational conditions to assure reception of signal.

END OF SECTION 275313
040119/212227

SECTION 281300 - ACCESS CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes access control door hardware for the following:

1. Swinging doors.
2. Sliding doors.
3. Other doors to the extent indicated.

B. Section includes, but is not necessarily limited to, the following for the integrated access control security and site management system:

1. IP-enabled integrated access control door hardware.
2. Monitoring and signaling equipment.
3. System network control processors.
4. Reader controller interfaces and modules.
5. Input monitor and output control interfaces and modules.
6. Remote card readers and display terminals.
7. Power sourcing equipment, network switches and wireless access points.
8. Access control cards and credentials.
9. Access control system application software.
10. Access control system power supplies, back-ups and surge protection.

C. Related Sections:

1. Section 017900 - Demonstration and Training: Operations and Maintenance.
2. Section 080671 - Door Hardware Schedule.
3. Section 081113 - Hollow Metal Doors and Frames.
4. Section 087100 - Door Hardware.
5. Division 26 - Electrical: Connections to electrical power system and for low-voltage wiring work.
6. Division 27 - Communications: Connections to the LAN.
9. Section 284620 - Fire Alarm System: Connections to building fire alarm system.

1.2 REFERENCE STANDARDS

A. BHMA A156.13 - American National Standard for Mortise Locks and Latches Series 1000; 2012.

B. BHMA A156.18 - American National Standard for Materials and Finishes; 2012.

C. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; 2004.

D. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors; 1993; also in WDHS-1/WDHS-5 Series, 1996.

E. IEEE 802.3 - IEEE Standard for Ethernet; 2015, with Amendments, 2016.

F. NFPA 101 - Life Safety Code; 2015.

G. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

H. TIA/EIA-568 - Commercial Building Telecommunications Cabling Standard; Rev C, 2012 and latest addenda.

I. Codes and References: Comply with the current version adopted by the Authority Having Jurisdiction.

1. See Section 014100 - Regulatory Requirements.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. System Operational Descriptions: Complete system operational narratives for the integrated access controlled openings defining the Owner's Prescribed Requirements for the opening functionality. Narratives include, but are not limited to, the following situations: normal secured/unsecured state of door; authorized access; authorized egress; unauthorized access; unauthorized egress; fire alarm and loss of power conditions, and interfaces with other building control systems.

C. Shop Drawings: Details of electrified integrated locking hardware and access control firmware, indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication and control of the access control system electrified hardware and firmware. Differentiate between Manufacturer-installed and field-installed wiring. Include the following:

a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
b. Complete (risers, point-to-point) access control system block wiring diagrams.

2. Electrical Coordination: Coordinate with related Division 26 Electrical Sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Proof of Certification: Provide copy of Manufacturer(s) official certification or accreditation document indicating proof of status as a qualified and authorized Provider of the primary access control components.

E. Keying Schedule: Reference Division 08 Section "Door Hardware".

F. Product Test Reports: Indicating compliance with Cycle Testing Requirements, based on evaluation of comprehensive tests performed by Manufacturer and witnessed by a qualified Independent Testing Agency.

G. Operating and Maintenance Manuals: Provide Manufacturers operating and maintenance manuals for each item comprising the complete access control and site management installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and telephone number of the Supplier/Integrator providing the installation and the nearest Service Representatives for each item of equipment included in the system. The final copies delivered after completion of the installation test to include "As Built" modifications made during installation, checkout, and acceptance.

1. Record Drawings: During system installation, the Contractor to maintain a separate hard copy set of Drawings, Elevation Diagrams and Wiring Diagrams of the access control system to be used for Record Drawings. This set to be kept up to date by the Contractor with all changes and additions to the access control system accurately recorded.

H. Warranties and Maintenance: Special Warranties and Maintenance Agreements specified in this Section.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage Qualified Manufacturers with a minimum of 5-years of documented experience in providing access control and security systems equipment and software similar to that indicated for this Project and that have a proven record of successful in-service performance.

1. Software and access control systems components to have been previously and thoroughly tested together with proven installations similar in size and functionality to the Design Requirements indicated for this Project.

B. Integrator Qualifications: Systems Integrators, verifiably factory trained and certified by the Primary Product Manufacturers, with a minimum 3 years documented experience installing complete integrated access control systems similar in material, design, and scope to that indicated for this Project and whose work has resulted in construction with a proven record of successful in-service performance. Qualifications include, but are not necessarily limited, to the following:

1. References: Provide a list of references for similar projects including contact name, phone number, name and type of Project.
2. Professional Staffing: Firms to have a dedicated access control systems integration department with full time, experienced professionals on staff experienced in providing on site consulting services for both electrified door hardware and integrated access control systems installations.
3. Factory Training: Installation and service technicians are to be competent factory trained and certified Personnel capable of maintaining the system.
4. Service Center: Firms to have a service center capable of providing training, in-stock parts, and emergency maintenance and repairs at the Project site with 24-hour/7-days a week maximum response time.

C. Supplier/Dealer Qualifications: Supplier/Dealers verifiably authorized and in good standing with the Primary Product Manufacturers, with a minimum 3 years' experience supplying integrated access control systems similar in material, design, and scope to that indicated for this Project and whose work has resulted in construction with a proven record of successful in-service performance.

D. Integrated Wiegand Output, Wireless, and IP-Enabled access control products are required to be supplied and installed only through designated ASSA ABLOY "Authorized Channel Partner" (ACP) and "Certified Integrator" (CI) accounts.

E. Source Limitations: Obtain the access control door hardware, system firmware and application software specified in this Section from a single source, qualified Supplier/Integrator unless otherwise indicated.

1. Electrified modifications or enhancements made to a Source Manufacturer's product line by a secondary or third party source will not be accepted.
2. Provide integrated access control door hardware from the same Manufacturer as mechanical door hardware, unless otherwise indicated.

F. Regulatory Requirements: Comply with Section 014100 - Regulatory Requirements and Guidelines as directed in the Building Code including, but not limited to, the following:

1. Comply with California Electrical Code, including electrical components, devices and accessories listed and labeled as defined in Article 100 by a Testing Agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Where indicated to comply with Accessibility Requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," CBC Chapter 11B as follows:

    a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
    b. Door Closers: Comply with the following maximum Opening-Force Requirements indicated:

        1) Interior Hinged Doors: 5 lbf applied perpendicular to door.
        2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Comply with NFPA 101 for doors in a means of egress.
4. Comply with NFPA 80 for fire labeled opening assemblies.
5. The installed access control system shall conform to all Local Jurisdiction Requirements.

G. Keying Conference: Reference Section 087100 - Door Hardware.

H. Pre-Submittal Conference: Conduct coordination conference in compliance with Requirements in Section 013000 - Administrative Requirements with attendance by Representatives of Supplier(s), Installer(s), Systems Integrator(s), and Contractor(s) to review proper methods and procedures for receiving, handling, and installing door and access control hardware to Manufacturer's recommendations and according to Specifications.

1. Prior to installation of door hardware, arrange for Manufacturers' Representatives to hold a Project specific training meeting on the proper installation and adjustment of their respective products. Product training to be attended by the Installers of access control hardware for the aluminum, hollow metal and wood door sections. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required Inspecting, Testing, Commissioning, and Demonstration Procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

1. Access control firmware and software: Where approved and directed, inventory upon receipt and store electronic access control equipment in a secure, temperature and humidity controlled environment in original Manufacturer's sealed containers.

B. Tag each item or package separately with identification related to the final Access Control Door Schedule, and include basic installation instructions with each item or package.

C. Deliver permanent keys, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner established at the “Pre-Submittal Conference".

1.6 COORDINATION

A. Coordinate quantity and arrangement of assemblies with ceiling space configuration and with components occupying ceiling space, including structural members, pipes, air-distribution components, raceways, cable trays, recessed lighting fixtures, and other items.

B. Integrated Access Control Door Hardware and Electrical Coordination: Coordinate the layout and installation of scheduled integrated access control door hardware, and related access control equipment, with required connections to source power junction boxes, power supplies, detection and monitoring hardware and fire alarm system.

1. Door Hardware Interface: The access control system to interface and be connected to electrified and integrated access control door hardware as described under Division 08 Sections "Door Hardware" or "Access Control Door Hardware". Coordinate the installation and configuration of electrified door hardware being monitored or controlled with the controls, software and access control hardware specified in this Section.

C. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing electrified door hardware and access control system components. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing access control system hardware to comply with Indicated Requirements.

D. Door and Frame Preparation: Related Division 08 Sections (Steel, Aluminum and Wood) doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article will not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and are in addition to, and run concurrent with, other warranties made by Contractor under Requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by Manufacturer(s), agreeing to repair or replace components of the installed access control system hardware and software that fails in materials or workmanship, including all related parts and labor, within specified warranty period after final testing and acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:

Two years for Integrated Access Control Door Hardware.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of standard and access control door hardware.

B. Maintenance Service: Beginning at Substantial Completion, and running concurrent with the specified warranty period, provides continuous 6-months full maintenance including repair and replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door opening operation. Provide parts and supplies as used in the manufacture and installation of original products.

C. Maintenance Support and Extended Service Agreement: Submit for Owner’s consideration an optional extended Service Agreement for the installed access control system, including support for software related issues. The extended Service Agreement is considered elective and is without Manufacturer's Requirement stipulating mandatory coverage for owner and/or vendor system support.

1. A published copy of this Agreement to be included with the submittal package
2. Support for the installed access control system components is provided through the Vendor under a 24 hour Technical Assistance Program.
3. Access control and management system components are to be available on a 1-day turn-around time frame from the Manufacturer.
4. Primary Systems Manufacturer to offer and provide remote modem or internet access for direct factory support to the Vendor. The factory level support to include diagnostics and troubleshooting support on systems related issues at no additional cost to the Owner.

D. Access Control Software Upgrades: Version upgrades and "fix" releases to the access control system software are available at no extra charge as long as the version of software provided in this Specification remains the current Manufacturer’s version or for up to 2-years after a new version release.

1. Major access control software revisions that provide new functionality to the product provided free of charge for up to 1-year from the date of substantial completion.
2. Access control system software is to be upgradeable as may be required or as necessary, to expand and manage the Owner’s site or sites. Upgrades are to be offered at a published flat fee for the primary system software, with single license modules included in the primary fee structure. System upgrades offered at a costing structure based upon the original number of licensed modules issued, or on those to be purchased at a future date, are not allowed.
3. As part of the submittal package, provide a list of available software upgrades and/or expansions modules. List to identify related costs for upgrades, or expansions to the original system, up to the next qualifying operational level.

1.9 SCOPE OF WORK

A. Access Control Site Management System: Furnish and install at the indicated locations the specified integrated access control door hardware and access control system firmware and software for a completely operational access control and security site management system. System includes, but is not necessarily limited, to the following:

1. Electrified integrated access control locks and exit hardware, network control processors, reader controller panels, I/O monitor/control interfaces, door position switches, remote card readers, keypads, and display terminals, access cards and credentials, system application software, special tools, operating manuals, and required cabling and accessories as detailed below and listed in the Access Control Hardware Sets at the end of Part 3.

    a. Provide the appropriate number of reader controller panels and I/O monitoring / control expansion interfaces as needed to handle the number of card readers, locking devices, door status devices, and identified alarm inputs specified in this section, and as shown on the Security Drawings.
    b. Provide Manufacturer approved integrated access control locks, exit hardware, and remote mounted card readers, keypads, and display terminals that are functionally compatible with the specified access control equipment interfaces.

2. Access control system equipment to be installed in an enclosure box compatible with the specified components. This enclosure to include, but is not necessarily limited to, the network control processor, I/O monitor/control interface panels, power supplies, terminal strips, wire ducts, keyed lock cylinder, integrated outlet for A/C power, and standoffs.

    a. Enclosure box to be located in the designated IT/Telecom room(s) with connection to the owner designated local area network for communication back to the central server host.

3. Owner to provide the following:

    a. Computer hardware and peripherals to be from an approved, Major Line Computer Manufacturer. The following Manufacturers will be considered “pre-approved”, however, specific information detailing compliance with the Manufacturer’s Requirements must be included within the Project submittal package as specified.

        1) Compaq
        2) Dell
        3) Hewlett-Packard
        4) IBM

    b. Central Server Host Computer:

        1) System Server to include the following Minimal Requirements: Windows Server 2003 (Service Pack 1 or higher) or later Operating System, Intel Pentium IV 1 GHz (equivalent or greater), SQL Server 2005 Express Edition or SQL 2005, 1GB Ram or larger, 120GB hard disk space available or more as needed, CRT or LCD minimum 15-inch display Monitor, CD/RW Drive. Single serial port, or multiple USB ports, and one parallel port, keyboard and mouse.

    c. Client Workstations:

1) Client Workstation to include the following minimal Requirements: Windows XP Professional (Service Pack 2 or higher) or Windows Vista Business, Intel Pentium III 500 MHz (equivalent or greater), SQL Server 2000 Client Access License, 1GB Ram or larger, 30GB hard disk space available or more as needed, CRT or LCD minimum 15-inch display Monitor, CD/RW Drive. Single serial port, or multiple USB ports, and one parallel port, keyboard and mouse.

d. Owner will be responsible for ensuring that each computer hardware component includes the required interfaces, expansion boards, and peripherals that will be necessary to allow the system to operate as described within this Specification and as indicated on the Drawings.
e. Power Sourcing, Network Switches and Wireless Access Points: Quantity as required to accommodate installed access control (and video surveillance) devices.
f. Network Control Processor Connections:

1) LAN/Ethernet communication ports (jacks) and network interface cards as needed, CAT5e (CAT6) cabling from network router/switch to network control processor, outlet and cover plates and/or patch cables required for network connection within each designated IT/Telecom room.
2) Required static IP addresses.

4. Power Supplies, including battery or uninterrupted backup powers supply (UPS) and separately fused surge protection, required for the electrified door hardware, access control equipment, and PoE switches or wireless routers driving the integrated card reader locking devices.
5. Installation, final configuration and commissioning of electrified door and access control system hardware, communication firmware, power supplies and related accessories.
6. System application software including installation, programming, and end user training of the access control system demonstrating operating, repair, and maintenance procedures. Include on-site central server training for designated Personnel (facilities maintenance, security, IT, administration) by a Factory Certified Representative.

a. Include Client Software Application (client workstation) training at each of the remote installed facilities for local Administrative Staff.

7. Provide Manufacturer required power controllers, interface boards, and programming that may be required for approved electric latch retraction exit devices supplied under Division 08 Section "Door Hardware."
8. Electrical Contractor, Division 26, to provide the following:

a. Source power wiring (120VAC) as required for the integrated locking and access control hardware, equipment, accessories and power supplies. This includes quad outlets as required on a dedicated circuit in the designated IT/Telecom room(s) and the related conduit, stub-in, junction boxes and connectors required for the source power delivery and connections.

b. Provide required conduit, stub-in, junction and back boxes for both the electrified locking hardware and access control equipment at each of the access controlled or monitored openings per Plan Drawings and Specifications. Supply and install conduit between each of the

aforementioned devices and between the electrical junction boxes, power supplies and access control equipment located on or above the door opening.

1) At wall mounted remote readers, provide conduit on the secured side of the door, 36-inches from the finish floor and 6-inches from the edge of the frame, to the related power supplies and access control equipment.
2) At electrical hardware power transfers provide conduit on the secured side of the opening from the power transfer, thru-wire hinge, or serviceable panel location on the frame jamb to the related power supplies and access control equipment.

c. Electrical Contractor to provide all 120VAC cabling connections and terminations from the electrical junction boxes to these electrical devices.

9. Access Control System Integrator to provide the following:

a. Low voltage wiring (12/24VDC) and communication cabling (RS-232/RS-485) from network control processors to reader controllers, I/O monitor/control interface panels, electrified and integrated locking hardware, remote card readers, keypads, or display terminals, monitoring and signaling switches, and power supplies. Work includes related connectors, final terminations, and hook-ups required for a complete and functional access controlled opening in accordance with applicable Codes and specified system operational narratives.

10. Elevator Contractor to provide the following:

a. Interface or landing of interface cable onto the elevator call button will be performed by a Certified Elevator Contractor.
b. Coordinate with access control systems integrator provisions for a card reader with output allowing the elevator call button to be activated. A validated card read will be required for activation.

11. Full and seamless integration of the analog, digital or IP-enabled CCTV video surveillance system (Division 28) if applicable, with the installed site access control system software.
12. Full and seamless integration of the site intrusion alarm service and motion detector systems, (Division 28) if applicable, with the installed site access control system software.
13. Final connections to fire alarm system, if required, by electrical and fire alarm system contractors.
14. Provide permits, submittals and approvals required by the authority having jurisdiction, prior to commencing with work.

PART 2 - PRODUCTS

2.1 SYSTEM ARCHITECTURE - ACCESS CONTROL SITE MANAGEMENT SYSTEM (ACSMS)

A. General: The ACSMS is a modular and networked based system providing physical access control security to a Wide Area District, campus or educational enterprise. The system to be capable of controlling and integrating multiple security functions including the configuration, management and monitoring of cardholder access, locking hardware units, events, alarms, visitors, and real-time tracking and reporting. The ACSMS is to be alterable at any time depending on the Facility Requirements and will allow for easy upgradeability or modification of network processors, controller, interface modules, card data, inputs, outputs, and remote work stations. The ACSMS to include, but is not be limited to, the following features and functions:

1. An "Enterprise" class access control software application.
2. Client/Server model operating central server host software modules and client workstation software applications in a multi-user and a multi-tasking environment.

    a. The ACSMS to permit multiple instances of client software applications to run simultaneously on the network. The base system to include software application licenses with an unlimited number of licenses available subject to connection fees.

3. Partitioning: The system to support security partitioning enabling system administrator to segment the configuration database and group multiple entities within the security partition.

    a. Security partitions limit what users can view in the configuration database. Administrators, who have all rights and privileges, can segment a database into multiple security partitions. A user who is given access to a specific partition will only be able to view entities (components) within the partition they have been assigned.

4. Encryption: The system to support encrypted communication between the central server software and client software applications (sever-to-server and client-to-server) using a 128-bit AES encryption algorithm (at a minimum).

    a. Communication between the central server host software module and system controllers to be encrypted if supported by the controllers.
    b. The ACSMS client software applications to be password protected with passwords stored in the central server database in an encrypted manner.

5. Distributed Processing: The system is a fully distributed processing application allowing information, including time, date, zones, valid Codes, tasks, access levels, and similar data, to be downloaded from the central host station to controller interface devices allowing access-control decisions with or without central host station communication. If communications to a central host station are lost, the controllers will automatically buffer event transactions until communications are restored and events are automatically uploaded to the central host station.

    a. Provide for a higher level of distributed database management at defined perimeter access points such that no single point of failure will allow more than two access points to fail, or affect more than two access points at perimeter points system wide.

6. Single Data Base: The system to support a single database for access control site setup, credential and identity file creation, alarm and control setup, and system user operation and command functions.
7. System Access Management: The system to allow operators through password authentication the ability to make access granted or denied decisions, define access levels, time zones, holidays, assign cardholders, access groups, develop tasks, and generally manage access control, alarm monitoring and response activities system wide from a single login. Operator and user privileges are managed by a system administrator allowing for different levels of system access and system control. Authorization management is fully Owner definable.
8. Cardholder Management: The system to include a cardholder management system integrated within the access control system. This cardholder management functionality allows the enrollment of card-holders into the database, and import/export of employee data.
9. Access Groups and Access Levels: The system to provide adequate access groups and access level assignment capability to meet Owner Requirements for the specified project. If required, software application can be expandable to support unlimited access groups and access levels.
10. Alarm Monitoring: The system is able to monitor, report, and provide information about the time and location of alarms, along with their priority.

11. Event Monitoring: The system is able to monitor, report, and archive network access control activity.
12. Transaction Logs: The system to support an unlimited number of logs and historical transactions (events and alarms) with the maximum allowed being limited by the amount of hard disk space available.
13. System Monitoring: The system to have ability to report on the integrity of all network assigned devices, circuits and communications and provide a diagnostics screen showing field level communications system wide
14. Lock/Unlock Commands: The system to allow an operator to manually lock and unlock doors over-riding scheduled access control restrictions and configurations if necessary.
15. Hardware Interface: The system to integrate with and control specified electrified hardware, signaling and monitoring devices.
16. Report Generator: The system to have the ability to generate and output reports with any and all combinations of system fields and data including, but not limited to: by cardholder, by door, by site, by time, by groups of doors and by cardholder field. Any and all combinations of fields must be available for reporting. The report feature to allow exporting of generated reports over a network connection or by remote printing.
17. Multi-User/Web Based Network Capabilities: The system to support multiple operator workstations via local area network/wide area network (LAN/WAN), the Internet, or VPN. The system to be capable of supporting minimum number concurrent Users/Clients with software expansions to an unlimited number of workstations based on the Owners Network Requirements.
18. Systems Integration: The system to have the ability to be fully and seamlessly integrated with existing or specified intrusion detection alarm and video surveillance (CCTV) systems.

B. Open Architecture: The access control system infrastructure will be based on an open Architecture Design capable of supporting multiple Access Control Hardware Manufacturers and integrate with multiple non-proprietary network processors, controllers, interface modules, integrated locking hardware, remote card readers, keypads and display terminals, and other third party applications.

C. Network Support: Communication network connecting the central server host software modules, Client work-station software applications, and hardware controllers to be designed to support all of the following:

1. LAN/Ethernet enterprise ring topology and localized star topology based on TCP/IP.
2. Direct-connected RS-232 and RS-485 communication cabling.
3. Dial-up modem connection using a standard dial-up telephone line.

2.2 MANUFACTURERS

A. Approved Access Control and Site Management System Manufacturers:

1. Corbin Russwin (Integrated Access Control Locking Devices and Accessories).
2. HID Global (Access Cards and Credentials, Remote Readers).
3. Sargent Manufacturing (Integrated Access Control Locking Devices and Accessories).
4. Securitron Corporation (Power Supplies).
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. General: Provide integrated access control door hardware and access control system equipment and accessories for each designated opening to comply with Requirements in this Section and with the Access Control Hardware Sets listed at the end of Part 3.

1. Access Control Hardware Sets: Requirements for quantity, item, model, design, grade, finish, size, and other distinctive qualities of each type of integrated door and access control hardware are indicated in the Access Control Hardware Sets at the end of Part 3.

2. Named Manufacturer's Products: Product designation and Manufacturer are listed for each door hardware type required for the purpose of establishing Minimum Requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. System Design: The equipment and materials supplied are to be standardized components regularly manufactured and utilized within the Source Manufacturer's access control systems.

1. System components to be non-proprietary in design and implementations, providing for an open protocol platform with multiple Manufacturers having functional software capable of integrating with the hardware specified. The installed integrated product is to be part of a single, cohesive management and access control system.

D. Substitutions: Requests for substitution and product approval for inclusive integrated access control door and access control systems hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Section 012500 - Substitution Procedures. Approval of requests is at the discretion of the Architect, Owner, and their Designated Consultants.

1. The access control system described in this specification represents a complete engineered system. If alternate products are submitted, it is the responsibility of the Supplier/Dealer/Integrator to provide an acceptable complete and working system layout, including re-engineering of elevation and wiring diagrams, as applicable. Complete systems to include at a minimum required power supplies, power transfers, and integrated access control locking hardware and accessories.

2.3 ACCESS CONTROL AND SITE MANAGEMENT SYSTEM HARDWARE

A. General: Provide all necessary access control field hardware devices required to receive alarms and administer all access granted/denied decisions. Field hardware devices must be designed and installed in accordance with applicable Electrical Codes.

B. Central Computer Host Server (Owner Provided): The central host server is interconnected to all system components, including client workstations and field installed controllers, providing operator interface, interaction, display, control, and real-time monitoring.

2.4 INTEGRATED IP-ENABLED ACCESS CONTROL DEVICES

A. IP Enabled Power-over-Ethernet (PoE) Integrated Card Reader Mortise Lock: IP enabled ANSI/BHMA A156.13 Grade 1 mortise lockset with integrated credential reader, request-to-exit, and door position signaling in one complete unit. Motor driven locking/unlocking control of the lever handle trim, ¾-inch projection latch bolt, and optional 1 inch steel deadbolt. Lock is UL listed and labeled for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override.

1. Acceptable Manufacturers:

a. Corbin Russwin Hardware (RU) - IN220 Series.
b. Mortise locks - IN220-ML20234 B OA BIP PSA M17 CT6R 626
c. Exit Devices - ED5200N IN220 PR9134 B OA BIP 5CH M110 CT6R 630 - Special App request for 5CH

d. Fire-Rated Exit Devices - ED5200AN IN220 PR9134 B OA BIP 5CH M110 CT6R 630 - Special App request for 5CH
e. Substitutions: See Section 016000 - Product Requirements.

2. Operational Narratives required at ALL Card Access openings.
3. Completely intelligent and integrated locking unit with Ethernet power and communication connection capability directly from the locking unit back to the central system host server without additional access control interfaces or components (excluding PoE Endspan and Midspan devices) via an existing or newly installed IEEE 802.3af PoE enabled network.
4. Open architecture design supports wired integration with third party access control systems applications via software development kit (SDK). Real-time software accessible alarms for forced door, unknown card and door held open, with inside lever handle (request-to-exit), battery status, tampering, and door position (open/closed status) monitoring.
5. 2,400 users and 10,000 event transaction history (audit trail). Distributed intelligence allows stand-alone operation in absence of network communication allowing for system operational redundancy.
6. Provide a network and lock configuration CD tool kit for initial lock setup and programming via a USB connection.
7. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
8. Integrated reader supports the following credentials:

   a. 125kHz proximity credentials: HID, AWID, Indala, and EM4102.
   b. 13.56 MHz contactless credentials: HID iClass, HID iClass SE, HID iClass Seos, SIO on MIFARE Classic, SIO on MIFARE DESFire EV1, MIFARE Classic, DESfire EV1, NFC-enabled mobile phones, Bluetooth Smart-enabled mobile phones.

9. Communication between access control system and device is protected by AES 128 bit encryption via the SDK. Programmable for time zones, holidays, and automatic unlocking.
10. Power and communication from one Ethernet (CAT5e or higher) cable. Compliant with IEEE 802.3af Class 1 device specifications requiring 3.84 watts for Power over Ethernet.
11. Supports real-time system lockdown capabilities. Inside lever retracts latch bolt and deadbolt simultaneously.
12. High security mechanical key provides emergency override retraction of latch-bolt without need for electronic activation.
13. Ethernet system framework, network cabling, mounting boxes, PoE end-span/mid-span, electrical hard wiring, grounding, and connections are required for complete system functionality. All system components are by others and are specified elsewhere.

    a. Power Requirement: PoE Class 2, maximum 7 watts.
    b. Network Cabling Requirements: Cat5e or higher meeting or exceeding ANSI/TIA/EIA-568-C. 24 AWG Plenum rated.
    c. Bonding and Grounding: Meet or exceed TIA-607-B Requirements. Connect device ground cable to building electrical earth ground.
    d. Network Surface Mount Box: Meet or exceed ANSI/TIA/EIA-568-C Requirements. CAT5e or higher (RJ45).

2.5 CABLES AND WIRING

A. Comply with Division 26 and 27

B. Data Line Supervision: System to include alarm initiation capability in response to opening, closing, shorting, or grounding of data transmission lines.

C. Install appropriate number of conductor pairs, in the wire gage (AWG) recommended by Manufacturer, corresponding to the electronic locking functions specified, amperage drawn and distances covered between the power supplies, power transfer devices, electrified hardware and access control equipment.

2.6 FABRICATION

Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to Manufacturers recognized installation standards for application intended.

2.7 ACCESS CONTROL HARDWARE FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain Manufacturers for their products.

B. Protect mechanical finishes on exposed surfaces from damage by applying temporary protective coverings before shipping.

C. Where specified, finishes on integrated card key locksets or exit hardware to incorporate an FDA recognized antimicrobial coating (i.e., MicroShield™) listed for use on equipment as a suppressant to the growth and spread of a broad range of bacteria, algae, fungus, mold and mildew.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with Requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance of the installed access control system.

B. Examine roughing-in for electrical source power to verify actual locations of wiring connections before electrified and integrated access control door hardware installation.

C. Examine roughing-in for LAN and control cable conduit systems to PCs, controllers, card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.

D. Notify architect of any discrepancies or conflicts between the Specifications, Drawings and Scheduled access controlled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

Doors and frames at scheduled access controlled openings to be properly prepared to receive specified electrified and access control hardware and connections without additional in-field modifications.

3.3 INSTALLATION

A. Install each item of integrated access control door hardware and access control equipment to comply with Manufacturer's written instructions and according to Specifications.

B. Mounting Heights: Mount integrated access control door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with Governing Regulations:

1. Standard Steel Doors and Frames: DHI (LOCS).
2. Wood Doors: DHI WDHS.3.
3. Where indicated to comply with Accessibility Requirements, comply with CBC Chapter 11B.

C. Boxed Power Supplies: Verify locations.

1. Configuration: Provide the least number of power supplies required to adequately serve doors with access control hardware and equipment.

D. Integrated Wiegand access control products, campus locks, and IP enabled products are required to be installed through current members of the ASSA ABLOY "Certified Integrator" (CI) program.

E. Final connect the system control switches (integrated access control door hardware, remote readers, keypads, display terminals, biometrics), and monitoring, and signaling equipment to the related controller devices at each opening to properly operate the electrified door and access control hardware according to system operational narratives.

F. Retrofitting: Install each door hardware and access control item to comply with Manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

G. Networked System Application Software: Install, and test application(s) software and databases for the complete and proper operation of systems involved. Assign software license(s) to Owner.

3.4 FIELD QUALITY CONTROL

A. Field Inspection: Perform a final inspection of the installed integrated access control door hardware and access control system and state in report whether installed work complies with or deviates from Requirements, including whether each component representing the opening assembly is properly installed, adjusted, operating and performing to system operational narratives.

B. Commissioning and Testing Schedule: Prior to final acceptance of the access control system installation, the following testing and documentation to be performed and provided to the Owner.

1. Inspection: Verify that units and controls are properly installed, connected, and labeled and that inter-connecting wires and terminals are identified.
2. Pre-testing: Program and adjust the system and pretest all components, wiring, and functions to verify they conform to Specified Requirements. Provide testing reports indicating devices tested, pass/fail status, and actions taken to resolve problem(s) on failed tests.
3. Acceptance Test Schedule: Correct deficiencies identified by tests and observations and retest until Specified Requirements are met.

4. Provide “As Designed” Drawings showing each device and wiring connection and electronic enclosure legends indicating cabling in and out.
5. Provide a complete set of operating instructions for access control hardware devices and a complete software user manual. The documentation includes module reference guides for each electronic enclosure.

3.5 ADJUSTING

Adjust and check each operating item of integrated access control door hardware, and each door opening to ensure proper secured operation and function of every unit. Replace units that cannot be adjusted to operate as intended.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all integrated access control door hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by access control system installation.

C. Clean operating items as necessary to restore proper finish and provide final protection and maintain conditions that ensure access control door hardware is without damage or deterioration at time of Owner occupancy.

3.7 DEMONSTRATION

Instruct Owner's Maintenance Personnel to adjust, operate, and maintain electronic integrated door hardware and the access control system.

3.8 ACCESS CONTROL HARDWARE SETS

A. The hardware sets listed represent the design intent and direction of the Owner and Architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the Architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. Refer to Door Hardware Schedule for hardware sets.

END OF SECTION 281300
040119/212227

SECTION 281600 – INTRUSION DETECTION SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other Specifications Sections and Drawings for related work required to be included as work under Division 26 0000, 27 0000, and 28 0000.
2. General Provisions and Requirements for electrical work.

1.2 PERFORMANCE REQUIREMENTS AND SCOPE

All intrusion detection equipment as specified herein is future and is indicated for reference only. Provide all conduit outlet boxes and power connections only for all devices as indicated on the Drawings.

PART 2 - PRODUCTS

2.1 SYSTEM FUNCTIONS

A. Provide provisions only for a complete supervised Intrusion Detection System as shown on the Plans including but not limited to master control panel, key pad stations, motion detectors, connections to door switches, a State Fire Marshal listed digital communicator and an automatic dialer.

B. Upon detection of an intruder by initiation of any device in the system, the system shall cause the annunciator LED to light and sound an alarm signal on the School's telecommunication system. Alarm information shall be sent by digital dialer to Central Station Alarm Monitoring Agency.

C. Systems shall detect the motion of a body taking not more than four steps in an area secured with motion detection equipment where entry doors or windows are possible access.

D. Each building area shall be on a separate zone with each zone controlled separately so that any building area may be secured while others remain unsecured.

E. The System shall be capable of off-site computerized access for remote access, programming and control.

2.2 CONTROL PANEL

A. Control/Communicator Panel shall be a DMP #XR-500N control panel with an integral digital communicator and shall be Underwriters Laboratories listed. All external circuit connections shall be UL listed as power limited in accordance with the provisions of Article 760 of the California Electrical Code (CEC).

1. Provide Point of Protection (POPEX) modules at the control panel for Popit module supervision.

2. Provide Point of Protection Identification Transponders (Popit) modules at building terminal cabinets to individually identify each detector in the system.

B. The Control/Communicator shall be IP based.

C. System shall include the following features:

1. Real time clock and test timer.
2. Battery charging circuit.
3. Battery voltage supervision.
4. Supervised automatic reset circuit breakers.
5. Onboard warning buzzer and diagnostic LEDs.
6. Automatic answer modem.
7. Lightning and RFI protection.
8. Central Station reporting format.
9. Printer/CRT interface module for on-site serial data printer recording or CRT display of events.
10. Quad serial output module for enhanced serial data interface capability for specific accessory modules and devices.
11. Individual zone responses.
12. Custom annunciator text.
13. Audible alarm output, steady or pulsed.
14. Automatic silencing.
15. Attack-Resistant enclosure and lock meeting Underwriters Laboratory Local Burglary requirements.
16. A minimum of eight auxiliary form "C" dry contacts for a variety of programmable responses to alarm and trouble conditions.
17. Transformer enclosure for internal mounting of Class 2 transformer.
18. Two telephone numbers with selective signaling options.
19. Individual zone responses.
20. Automatic test reports.

2.3 BAR-CODE

Bar-code programmer for diagnostics and programming capability.

2.4 RECEIVER

A. Receiver shall be Bosch Security System #D6600 Series, UL listed for fire and intrusion detection.

B. Provide a 50VA Class 2 plug in transformer for power input.

C. System shall contain 48 hours of standby power utilizing rechargeable sealed lead acid batteries and a battery charger.

D. System shall be FCC approved for telephone connections.

E. An alphanumeric LCD Display shall indicate account number, area number, time, date, event, zone or point number, line or group number, status and external devices.

F. Twenty-four hour Clock and 128 year calendar.

G. Forty Character Line internal printer and interface capability with an external serial printer.

H. Transmission Verification appropriate with the format utilized.

I. Storage of 249 separate events.

J. Transmission Format shall support the control panel.

K. Turn the Receiver over to the District for Central Station or Campus Monitoring.

2.5 REMOTE ACCOUNT MANAGER

A. System shall be Bosch Security Systems #D5300 Series or equal with all equipment necessary for computerized access, programming, diagnostics, and remote control of the system. It shall be possible to remotely change passcodes, locate faults, shunt problem zones, arm and disarm the system, silence alarms, and control the auxiliary output contacts in the control panel.

B. System shall permit remote diagnostics including utility and battery power conditions, phone line condition, event memory by zone, and current clock and calendar settings.

C. System shall be 100% IBM compatible for use with personal computers.

D. System shall include a plug-in modem and software necessary for a complete and operable installation. Furnish the District with a Software License Agreement for updated software enhancements as they develop.

2.6 KEYPADS

A. Master Keypad shall be DMP or equal capable of displaying system status and controlling the alarm system. Unit shall receive its operating power from the main control panel. Keypad shall be flush-mounted on a wall near the entry doors of each building. Faceplate shall be brass or stainless steel as selected by the Architect.

B. Sub-Zone Keypads shall be DMP or equal to allow individual zones to be bypassed. Keypad shall be flush wall where shown on Plans Faceplate shall be brass or stainless steel as selected by the Architect.

2.7 MOTION SENSORS

Motion sensors shall be Honeywell DT-7450 with Bosch B328 mounting bracket. Sensors shall be dual performance, dual event devices to minimize false alarms or equal passive infrared devices detecting thermal motion signals. Sensor coverage patterns shall be as required for optimum coverage at each individual location. Sensor shall be adjustable Gimbal mounted with plate and outlet box. Provide an attack resistant enclosure DS AE774 at Multipurpose and Gymnasium areas.

2.8 MAGNETIC SWITCH

Magnetic switch shall be fully concealed in the door frame, Admeco, Sentrol or equal.

2.9 INTRUSION DETECTION SYSTEM

Each Intrusion Detection System terminal cabinet shall contain a power supply for motion sensors and/or POPIT/POPEX (Zonex) modules.

2.10 CABLING

Cabling shall be as required for system operation. All cabling shall be shielded.

2.11 SIREN

Siren shall be ATW (Mascon) PR-D550PW or equal.

PART 3 - EXECUTION

3.1 MOTION SENSORS

Locate motion sensors to provide optimum coverage of the space and to avoid conflicts with the architectural aesthetics of the building. Submittal Drawings shall show the exact locations of all system sensors and keypads for approval by District's Maintenance Managers.

3.2 CONCEALED DOOR SWITCH

Coordinate concealed door switch installations with Finish Hardware Manufacturer.

END OF SECTION 281600
040519/212227

SECTION 284620 - FIRE ALARM

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other Specifications Sections and Drawings for related work required to be included as work under Division 26, 27 and 28.
2. General Provisions and Requirements for electrical work.

B. This Specification provides the Minimum Requirements for the Fire Alarm and Detection System. The system shall include, but not limited to all equipment, materials, labor, documentation and services necessary to furnish and install a complete, operational system to include but not limited to the following functions:

1. Smoke and fire detection.
2. Off-premise notification.
3. Mass Notification system.
4. One-way voice communication notification system.
5. Two-way voice communication system.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Submit eight copies of the following to the Architect for approval.

1. A listing of all fire alarm components and equipment including the California State Fire Marshal (CSFM) listing numbers.
2. CSFM listing sheets of all devices being used.
3. Manufacturers' standard catalog data for fire alarm components.

    a. The submittal shall be arranged in the order of the Specification and shall list the Specification paragraph number, the name, the proposed Model and Manufacturer for each item as well as a reference indicating the specific piece of data which can be easily located in the brochure.
    b. The Manufacturers' data sheets shall be marked to indicate the specific item being proposed in cases where the sheet covers several types or sizes of item. The data sheet shall completely describe the proposed item.
    c. Where modification to the equipment is necessary to meet the Operational Requirements of the Contract Documents and the data sheets shall include complete Mechanical and Electrical Shop Drawings detailing the modification.

4. A listing of the outlet rough-in needed for every device and equipment item. The applicable symbol which illustrates that rough-in item on the Job Plans shall be drawn on the proposal, opposite the description of the rough-in to facilitate locating the data by Field Personnel.
5. Elevation and dimensional information.

1.3 APPLICABLE STANDARDS

A. The Equipment shall be listed, labeled, and approved for the application shown in Contract Documents, as fire alarm equipment complying with the following Requirements:

1. List of applicable Codes:

a. Building Standards Administrative Code, Part 1, Title 24 C.C.R.
b. California Building Code (CBC), Part 2, Title 24 C.C.R.
c. California Electrical Code (CEC), Part 3, Title 24 C.C.R.
d. California Mechanical Code (CMC), Part 4, Title 24 C.C.R.
e. California Plumbing Code (CPC), Part 5, Title 24 C.C.R.
f. California Fire Code (CFC), Part 9, Title 24, C.C.R.
g. California Referenced Standards Code, Part 12, Title 24, C.C.R.
h. Title 19, C.C.R., Public Safety, State Fire Marshal Regulations.
i. California Energy Code (CEC, Part 6, Title 24 C.C.R.

2. NFPA Standards and Guides:

a. NFPA 13, Automatic Sprinkler Systems.
b. NFPA 14, Standpipes Systems.
c. NFPA 14, Dry Chemical Extinguishing Systems.
d. NFPA 17A, Wet Chemical Systems.
e. NFPA 24, Private Fire Mains, (included the latest NFPA 13).
f. NFPA 72, National Fire Alarm Code, (California Amended).
g. NFPA 253 Critical Radiant Flux of Floor Covering Systems.
h. NFPA 2001, Clean Agent Fire Extinguishing Systems.

3. The fire alarm system shall conform to the applicable Standards and Guides referenced in CBC Chapter 60.

B. Written Certification by the Fire Alarm Equipment Manufacturer shall be submitted to the Architect, stating that the system and its component parts are listed and approved by the California State Fire Marshal and the Installation has been Tested, is Operational and Conforms to the Requirements as set forth in Part 3, Article 24, Title 19, California Code of Regulations.

1.4 EQUIPMENT AND INSTALLING QUALIFICATIONS

A. The Equipment shall be manufactured by Simplex to match existing fire alarm equipment on the Campus.

B. The Specification is based on the equipment of Manufacturers who have been approved by the District and the Manufacturers herein named shall be considered as meeting the Requirements of this Specification. For all items which are identified by part number and Manufacturer the Performance Specifications which are published in the most recent Manufacturer’s data sheets available at the time of bidding this Project shall be applicable to the present work as though fully written out herein.

C. All equipment shall conform to all local applicable Codes and Ordinances, and shall be listed by Underwriters Laboratories.

D. To Qualify as an acceptable Bidder, whether the bid is submitted to the District, his Agent, a General Contractor or a Sub-Contractor, the System Bidder or Contractor shall be qualified Fire Alarm Contractor and shall hold a valid C10 License issued by the Contractors State License Board of California. The System Bidder or Contractor shall hereinafter be referred to as the Contractor. The Contractor shall hold all other licenses required by the legally constituted Authorities Having Jurisdiction over the work. The Contractor shall be the Factory Authorized Distributor for the branch of equipment offered and shall have been engaged in the business of supplying and installing the specified type of system for at least 5-years. The Contractor shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment. The Contractor shall be financially able to provide a performance bond covering the work and the guarantee described. The Contractor shall provide that bond if requested.

E. Installation Certification

1. Work and material for cables, cable terminations and related components shall be performed by Certified Installers. The Installer shall be certified by the respective Product Manufacturers.
2. The Manufacturers of the indicated work and material shall provide an Installer Education/Training and Certification Program for the supplied products.
3. The Installers performing the Contract work for the indicated products shall have attended and successfully completed each of the respective Manufacturer's installation training education programs for the specified products.
4. Submit six copies of the Manufacturer's Certifications for each Installer performing the work. The submittal shall be approved prior to initiating any related Contract Work.
5. Contract material installed and work performed by Installers not complying with these Requirements shall be removed. Removal of work and material not in compliance with these Requirements shall done at the Contractors' expense, without any additional cost to the Contract and without any Additional Contract completion due date extensions. New material and work required to replace the non-compiling removed work and material shall be provided at the Contractors' expense, without any additional cost to the Contract and without any additional Contract completion due date extensions.

PART 2 - PRODUCTS

2.1 GENERAL SYSTEM OPERATION

A. System shall be microprocessor-based, addressable, and power-limited with Class B supervised circuits, one-way and two-way emergency audio communications.

1. The microprocessor shall execute all supervisory and control programming to detect, report the failure or disconnection of any system module or peripheral device and initiate programmed control sequences. An isolated supervision "watchdog" circuit shall monitor the microprocessor and, upon failure, shall activate the system trouble circuits.
2. The automatic fire detection and alarm system shall consist of main control panel, transponder panel(s), notification alarm devices, remote annunciator, automatic detection devices, manual stations, printer, and CRT/keyboard, installed and wired in accordance with the Drawings and shall function as specified herein.
3. The system shall be programmable in the field, by a non-computer trained person. All programmed information shall be stored in non-volatile memory.
4. The system shall operate both addressable and non-addressable ionization, thermal and photoelectric detecting devices, manual stations, water-flow switches, and external control modules.

5. The control panel shall provide power, annunciation, supervision and control for the fire detection and alarm system. The system shall be designed such that alarm indications override trouble and control conditions.
6. External Circuit Supervision shall not require additional wires other than the pair used for detection or alarm (only two wires shall be used from the control panel to each loop of initiating devices and two wires for the notification alarm devices). These two wires shall provide both supervision and notification alarm signals. There shall be no loss of Supervision for Class "B" wired addressable devices. Class "A" Supervision may be provided by adding an additional pair of wires.

B. Alarm Conditions

1. Actuation of any manual or automatic alarm initiating device, connected to the system shall cause the following automatic functions.

    a. All notification alarm signaling units shall activate continuously. Audible notification alarms shall sound the California State Coded Signal.
    b. The respective zone alarm lamp or annunciator alphanumeric readout on the central control panel, and remote annunciator panel, shall be activated.
    c. Activate the Digital Alarm Communicator system.

2. Actuation of HVAC air duct smoke detectors shall stop the designated fans and motors in the building's air distribution system.
3. Actuation of smoke detectors on either side of smoke doors shall energize the release mechanism on the smoke door causing the door to close.
4. Notification alarm signal duration shall be capable of continuous sounding or adjustable from 3 to 10-minutes.
5. Perform any additional functions as specified herein or shown on the Drawings.

C. Trouble Condition

1. A single open or single trouble condition in a manual or automatic fire initiating wiring circuit shall activate the respective zone trouble lamp or annunciator readout on the fire alarm control panel and sound a trouble signal at the control panel.
2. A single open or single trouble condition in the notification alarm signaling wiring circuit shall activate the trouble lamp or annunciator readout in the control panel and sound a trouble signal at the control panel.
3. 120 volt AC normal power shall be monitored with indication by a "power on" lamp. Upon normal power outage, the system shall activate power trouble condition lamp or annunciator readout, and indicate a trouble condition.
4. The control panel shall monitor the standby batteries and, upon a low battery condition, activate the low battery lamp or annunciator readout and indicate a trouble condition.
5. System ground detection shall be provided for the entire system. Upon ground detection, activate the ground detection lamp or annunciator readout and indicate a trouble condition.

D. Control panels employing alphanumeric readouts shall display the trouble condition along with a prompt to review the list chronologically. The end of the list shall be indicated.

2.2 FIRE ALARM CONTROL PANEL

A. General

1. The fire alarm control panel shall be software programmable, microprocessor controlled, solid state, electronic integrated system. The panel shall be the product of one Manufacturer. The control panel shall provide power, annunciation, supervision and control for the detection and alarm system. The detection system shall remain 100% operational, responding to an alarm condition while in the routine maintenance mode.
2. Addressable detection and control devices shall be individually identified by the system, and any quantity of addressable detection devices shall be in alarm and any quantity of addressable control units shall be operable at any time up to the total number connected to the system.
3. The microprocessor shall access the system program, which is stored in non-volatile programmable memory, for all Control-By-Event (CBE) functions. The system program shall not be lost upon failure of both primary and secondary power. Volatile memory shall not be acceptable.
4. A means shall be provided for acknowledging each abnormal condition. Each activation of the appropriate acknowledges button shall sequentially acknowledge every point in the system. After all the points have been acknowledged, the LEDs shall glow steady and the panel audible signal will be silenced. The total number of alarms, supervisory, and trouble conditions shall be displayed along with a prompt to review each list chronologically. The end of the list shall be so indicated.
5. An alphanumeric annunciator readout shall indicate on the control panel the activation by type, loop, and address of the specific device, sub-loop or alarm/monitor/control point via an alphanumeric display. An audible alert shall sound at the control panel and an alarm light shall flash.
6. If the microprocessor fails, the system shall executive a default signaling program. This program shall enable the control panel to sound the audible signals and summon the Fire Department. In addition, a red LED shall light to indicate the communication loop wherein the alarm originated. Inability of the system to sound signals or summon the fire department during microprocessor failure shall not be acceptable.
7. Protected access to the system controls shall be provided to allow the user/operator access to the following system functions:

    a. Status of all addressable points.
    b. Status of all events logged.
    c. Set/change the real-time clock and date.
    d. Perform an operational manual test of the system from the control panel, including actuation of any initiating device and trouble circuit without alarming the remote central station. The panel shall automatically return to normal mode in the event the panel remains unattended in the service mode.
    e. Retrieve from event log the last 300 alarms, or control points and 300 trouble conditions.

8. Individual input (monitor) and output (control) device addressability shall all be performed on the same pair of wires. Wiring shall be Class "A" or "B". When Class "B" wiring is used, no special wiring sequence shall be required on addressable device circuits. An unlimited number of wiring branches shall be permitted with no loss of supervision.
9. A minimum of 25% addressable monitor, trouble and control points shall be provided.

B. Cabinet

1. A metal tamper resistant cabinet shall contain the control panel components. Panel shall be surface or flush mounting as indicated on the Drawings. Provide a full height tamper resistant hinged locking cabinet door. The door shall have transparent, high impact windows to allow visual observation of all indicators and switches without opening the panel door.

2. "In-out" circuit conductors shall terminate on numbered screw-type terminals.
3. All groups of circuits or common equipment shall be clearly marked and shall be expandable by inserting interchangeable units.

C. The Control Panel shall provide positive protection against the fire alarm system inadvertently being left in a non-operating status. The alarm system shall automatically restore and resound alarms and trouble signals, if subsequent alarm initiating or trouble signals are received under any of the following conditions:

1. After the alarm or trouble silence switch have been activated.
2. Prior to resetting system after previous alarm or trouble conditions.

D. The System Indicating and Operational Control Devices shall be mounted on the control panel face behind the panel door and shall provide the following minimum functions:

1. Individual visual indicating pilot lights annunciator or alphanumeric readout to monitor the following alarm system conditions:

    a. Input power.
    b. System common alarm.
    c. System common trouble.
    d. Alarm or trouble signal silenced.
    e. Ground fault.
    f. Battery condition.
    g. Each individual alarm, control or initiating zone-activation.
    h. Each individual alarm, control or notification zone-trouble.
    i. Report, by specific device number, any device removed from an addressable initiating circuit, all other devices shall continue to function.

2. Manual control switches to allow the following system controls:

    a. Alarm silence.
    b. Trouble silence.
    c. Test all indicating pilot lights and readouts.
    d. System reset, including remote devices connected to the alarm panel.
    e. Alarm test to initiate an alarm condition from the control panel.
    f. Alarm disconnect for system testing without activating the Digital Alarm Communicator system.
    g. Changing the status of configured circuits (arming or disarming and changing status of relays). If any change in status degrades system operation as configured, a trouble condition shall be reported and remain until system operation again meets configured status.
    h. Perform multiple operations at the same time. These operations shall include but not be limited to timed functions and multiple configured sequences.

E. Alarm Initiating Zone Modules.

1. Shall supervise and accept remote alarm actuating device input signals. An alphanumeric readout shall indicate separate zone alarm and trouble indicators for each zone.
2. Zones shall be compatible, and designed to operate with the connected initiating devices either addressable or non-addressable type.
3. A spare double throw set of software programmable auxiliary alarm relay contacts shall be provided for control of remote devices for each zone. Contacts shall be rated 120-volt 60Hz 3-amp.
4. Each device on the system shall report as its own unique address.

F. Notification Alarm Signal Control.

1. Shall supervise and activate remote notification alarm devices.
2. Notification alarm shall be compatible and designed to properly operate with the connected audio and visual notification alarm devices, with no signal degradation.
3. The notification alarm shall provide group notification signal control of all notification zones.
4. The alarm modules shall be field resettable to provide either continuous or coded notification alarm signals. The coded alarm signal shall provide an intermittent "on-off" pulsed sound activation of audible notification alarm devices.
5. A notification alarm circuit trouble indicating readout shall be provided for each notification zone.

G. Audio

1. The system shall be capable of delivering multi-channel audio messages simultaneously over copper and/or fiber media. All audio messages and live pages shall originate at the one-way audio control unit. The one-way audio control unit shall store pre-recorded audio messages digitally. These messages shall be automatically directed to various areas in a facility under program control. The system shall support remote cabinets with zoned amplifiers to receive, amplify and send messages through speakers over supervised circuits. The one-way emergency audio control shall provide control switches to direct paging messages as follows:

    a. "All Call" to direct the page messages to all areas in the facility, overriding all other messages and tones.
    b. "Page to Evacuation Area" to direct the message to the evacuation area(s), overriding all other messages and tones.
    c. "Page to Alert Area" to direct page messages to the area(s) receiving the alert message and tones, overriding all other messages and tones.
    d. "Page to Balance Building" to direct page messages to the areas) in the facility NOT receiving either the evacuation area or alert area messages.
    e. "Page by Phone" switch to select the Firefighters telephone system as the source for paging.

2. The system shall be capable of delivering multiple audio messages simultaneously over copper and/or fiber media. All audio messages and live pages shall originate at the one-way emergency audio control unit. The one-way emergency audio control unit shall store pre-recorded audio messages digitally. These messages shall automatically directed to various areas in a facility under program control. The system shall support remote panels with zoned amplifiers to receive, amplify, and distribute messages through speakers over supervised circuits.
3. The two-way voice communications control unit shall provide two-way communications between remotely located phones and the command center. The control unit shall provide the ability to individually select and display each two-way voice communication circuit support up to five remote telephones in simultaneous two-way voice communications.
4. Audio Amplifiers (Multi-Channel)
5. Provide one 20-watt audio amplifier per paging zone. There will be a total of two 20-watt amplifiers (one per floor). The system software shall be capable of selecting the required audio source signal for amplification. To enhance system survivability, each audio amplifier shall automatically provide a local 3-3-3 1000Hz temporal pattern output upon loss of the audio communications with the one-way audio control unit, during an alarm condition. Audio amplifiers shall be power limited and protected from short circuits conditions on the audio circuit wiring. Each amplifier output shall include a dedicated, selectable 25/70 Vrms output. Provide a standby audio amplifier that will automatically sense the failure of a primary amplifier, and replace the function of the failed amplifier.

H. Automatic ground detection shall detect either positive or negative voltages when earth connections of 50,000 OHMS or less occur, and activate the ground trouble signal.

1. A ground fault code shall provide indication of either a positive or negative ground fault and shall operate the general trouble devices as specified herein but shall not cause an alarm to be sounded.
2. A short circuit error message shall be a standard feature of the fire alarm control panel. Each communication loop shall be monitored for short circuits and shall have a distinctive error message for visual indication of circuits and operating trouble devices as specified herein but shall not cause an alarm to be sounded.

I. Power Supply

1. The dedicated power supply shall be adequately sized to properly operate the equipment, including remotely connected, spare and future indicated equipment with all alarm devices in alarm condition. Provide 20% spare power supply capacity for future expansion. Provide transfer modules and multiple power supplies as required for proper operation.
2. Input voltage 120/240 volt or 120/208 volt 60Hz AC.
3. Surge transient voltage protection on the input and output phases of the power supply shall be provided.
4. Supervised voltage types (i.e., 120-volt, 60Hz AC, 24 volt,AC, 24 Volt D.C., etc.) required by special connected equipment shall be supplied, including but not limited to:

    a. Alarm initiating devices.
    b. Notification alarm devices.
    c. Control and annunciator panels.
    d. Fire and smoke dampers.

5. A solid-state power transfer circuit shall provide (UPS) Uninterrupted Power Supply between internal standby power and line power automatically and instantaneously if normal power fails or falls below 15% of normal ("brown out" conditions).
6. Individual circuit fuses shall be provided for smoke alarm detector power, main power supply notification circuits, battery standby power, and auxiliary output.
7. Provide lock-on device on each power supply dedicated branch circuit breaker at panel.

J. Battery Back-Up Operation

1. Internal batteries and battery power supplies shall be provided to allow 60-hours continuous automatic normal operation of the entire control panel and fire alarm system after the failure of the incoming utility power. Sufficient battery capacity shall remain at the end of 60-hour period to provide 10-minutes of continuous operation of all connected notification alarm devices.
2. Batteries shall be maintenance free, sealed, lead-acid or lead calcium or gelled electrolyte type rated 25% larger than required to provide power for the entire system upon loss of normal 120 VAC power for a period of 60-hours with 15-minutes of alarm signaling at the end of this 60-hour period.
3. The battery charger shall be automatic, dual rate with capacity to recharge completely discharged batteries in 18-hours. Charger shall be temperature compensated.

K. Lightning and transient voltage surge protection shall be a standard feature of the fire alarm control panel and shall be incorporated in the power supply circuit, common control circuits, signal circuits, and telephone line circuit.

L. Circuitry shall be provided in the control panel to permit transmission of trouble and alarm signals over leased or privately owned telephone cables to a remote receiving panel. A reverse polarity or a master box circuit as required shall be provided in the control panel. There shall be a supervised disconnect switch to allow testing of the fire alarm signal without transmitting an alarm signal to the central station.

M. The Alphanumeric Annunciator (printer and CRT/keyboard) shall list upon request:

1. Alarms with time, date and location.
2. Troubles with time, date and location.
3. Status of output functions, "on" or "off".
4. Sensitivity of addressable smoke detectors.
5. Detection device number, type and location.
6. Status of remote relays, "on" or "off".
7. Acknowledgment time and date.
8. Signal silence time and date.
9. Reset time and date.

N. The System shall also provide the following:

1. Counting the number of addressable detectors within a "Zone".
2. Which are in alarm.
3. Counting "Zones" which are in alarm.
4. Counting the number of addressable detectors which are in alarm.
5. Alarm on the system.
6. Differentiating among types of addressable detectors such as smoke detectors, manual stations, water-flow switches, thermal detectors.
7. Assigning priorities to types of detectors, zones or groups of detectors.
8. Cross-zoning.

O. Control Functions

1. Control functions shall be assigned on the basis of multi-relational system initiation patterns of detection devices including full logic element equations using as "anding" zones, counting zones, counting devices, "anding" groups, conditional "if", "then", "or" programming and "anding" types of detection devices.
2. Control functions shall be assigned on the basis of, cycle, delay, count, time of day, day of week, day of month and with a holiday schedule of up to 30-holidays per year. Each addressable detection device shall report its condition to the system control unit not less than every 4-seconds in a manner such that failure of the connections to the internal electronics of the device will result in a trouble signal which identifies the specific device involved.
3. The system shall be field programmable for the response of control points to monitored devices.
4. The operating software program shall provide programmable control for the Event-Initiated-Programs (E.I.P.) which shall allow automatic operation of system control points in the event of an alarm condition. To program these E.I.P.s, the system shall use a specifically designed user friendly programming language, which shall not require a knowledge of computer programming to learn and understand.
5. The operating software shall support the following additional capabilities:

    a. Three levels of designated and unique Priority Alarms for each point.
    b. Designated "Sense Mode" for status interpretation for each point.
    c. Designated Print/No Print/Vectoring Mode for each point.

6. The input statement defines the conditions required to activate the associated output statement. The input statement shall consist of single or multiple monitor point status, subroutine status, time comparison and the utilization of AND, OR, NOT, COUNT, and DELAY logic functions.
7. The output statement defines the action to be taken by the control panel. The output statement shall consist of activation/deactivation of single or multiple control functions, subroutines, and remote annunciator status LED's. Output statements shall also include the "Alert" messages.
8. The software shall provide an "Alert" message, unique to each point in the system, which will provide specific instructions for the operator on duty. These messages shall be up to five lines with up to 70-characters in each line. Each system monitor point shall have five specific alert messages when in alarm. Control points shall also be assigned alert messages.
9. The hardware and software shall have the capacity to accept up to 64-independent programs. Each program shall have "Edit" or "No Edit" capability. Each program shall be written in an equation format comparable to ladder-logic equations. The Equations shall consist of an input and an output statement.
10. Provide initial programming services for Coding, Loading and Debugging the initial District specified programs, as part of the Contract.
11. Programming Command Definition

    a. Timing command shall provide time delay and time control functions based on internal clock/ calendar by time of day; day of week; day of month; month in year.
    b. Count command shall provide a specific number of events to occur before a control action is initiated.
    c. Pulse command shall provide on control for a specific period of time.
    d. Cycle command shall provide on-off control for preset periods of time.
    e. Print command shall provide printing of specified information after an event occurs.

2.3 FIRE ALARM DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Enclosure shall be red.

B. Panel shall be solid state with eight zones for off premise monitoring of the fire alarm control panel.

C. System shall monitor alarm and trouble conditions. System shall be power limited.

D. System shall include dual telephone line switcher for central station reporting. Telephone lines shall be supervised.

E. System shall include dual battery harness, batteries, and battery charger.

F. System shall be UL listed for central station fire signaling systems (NFPA 71).

G. System shall be California State Fire Marshal approved for central station reporting.

H. System shall be Radionics D8112FA Series or Simplex 5071 Series. System shall be approved for connection to the fire alarm control panel.

I. Verify Specific Requirements with District and central station prior to submittals.

2.4 MANUALLY ACTIVATED ALARM INITIATING DEVICES

Manual fire alarm boxes shall comply with CBC Sections 11B-309 and 11B-403.

A. An electronic, digital multiplex, addressable module shall be incorporated into each device. The module shall communicate the status and trouble condition of each device with a unique address code. The module shall communicate with and be supervised and monitored by the fire alarm control panel.

B. Devices shall be suitable for use on a Class "B", 2-wire supervised alarm initiating circuit.

C. Numbered screw type terminals shall be provided for "in-out" connections of the alarm circuit wiring.

D. The face of the station shall have lettering indicating "FIRE" and operational instructions. Stations shall be tamper resistant, semi-flush mounting.

E. Auxiliary spare switch contact shall be provided for control of remote devices rated 120 volts - 60Hz, AC - 3AMP minimum.

F. Stations shall provide visual indication the station has been activated. A key (and/or special tool) shall be required to gain access into the station to reset the station after being activated.

G. Stations shall be "nonbreak-glass" type.

H. RF and transient filtering shall be provided in the device electronics.

I. Pull stations shall be non-coded double action, requiring a two District manual "pulling" actions to initiate the fire alarm system.

J. Stations installed outdoors shall be weather resistant construction, double action to activate the pull station.

2.5 AUTOMATIC ALARM INITIATING DEVICES

A. General

1. An electronic digital, multiplex, addressable module shall be incorporated into each device. The module shall communicate the status and trouble condition of each device with a unique address code. The module shall communicate with and be supervised and monitored by the fire alarm control panel.
2. Devices shall be suitable for use on a Class "B", 2-wire supervised alarm initiating circuit. Where initiating devices are shown connected to an existing system, devices shall operate on 2 or 4-wire circuits plus, 2-wire power circuit as required by the existing equipment.
3. Numbered screw type terminals shall be provided for "in-out" connectors of the alarm circuit wiring.
4. Auxiliary double throw spare relay contact shall be provided for activation of remote rated devices 120-volt 60Hz, AC, 1-amp minimum.
5. RF and transient filtering shall be provided in the initiating device electronics.
6. Initiating devices shall be reset from the control panel and shall not require individual resetting.

B. Smoke Detector

1. Detectors shall comply with UL Standard 268, 167 and 168, and shall use solid state electronic circuits throughout.

2. The smoke detector shall operate on a total of two circuit wires. Alarm signaling and detector power shall use the same conductors. Detector sensitivity shall be factory set at 1.5%. Provide testing provisions in accordance with CFC 904(a) – 904.2(f), NFPA72.
3. A fine mesh insect screen shall be provided on all detector openings.
4. The detector shall lock-in on alarm and shall provide a visual alarm/trouble indicator light. An electromechanical test feature shall provide functional testing of the unit without smoke.
5. The detector shall also incorporate a fixed temperature heat detector rated at 135 degrees F. The heat detector shall operate the alarm circuit and alarm/trouble light.

    a. Photo electric type smoke detectors shall employ a Light Emitting Diode (LED) as the detector light source, activated by the presence of combustion smoke products. Failure of the LED shall activate the alarm/trouble light on the detector.
    b. Ionization type smoke detector shall employ the triple chamber (dual chamber) ionization principle, activated by the presence of combustion products. The ionization chamber shall be RF shielded.
    c. Air duct smoke detector photo electric or ionization type for installation on a mechanical air ducts. Two air tubes shall extend into the air duct. The sampling tube shall extend across the entire width of the air duct. The second tube shall allow air to escape back into the duct.

C. Fire Detector - Heat

1. Heat detectors shall be dual action electro-thermostatic combination rate of temperature rise and fixed temperature operation. An indicator shall be visible when detector has activated.
2. The rate of rise element shall be self-restoring, after activation.
3. The fixed temperature unit shall be set at 136 degrees F (190 degrees F for high temperature areas i.e. over 110 degrees F).
4. Provide a wire guard cover for the detector.

2.6 NOTIFICATION ALARM DEVICES

A. General

1. Notification alarm devices shall activate automatically from the control panel. Devices shall operate on a Class "B" (Style Y), 2-wire supervised alarm notification circuit. Series wired alarm devices shall not be used.
2. Numbered screw type terminals shall be provided for "in-out" connections of the alarm circuit wiring.
3. Devices shall be installed in a box, 3½-inches deep maximum, flush mounting unless indicated otherwise on the Drawings. Size as required for the alarm indicating device and wiring connections. Provide a trim ring and metal grill cover assembly. Cover assembly shall be a minimum of 1/16-inch minimum thick flat stainless steel or aluminum. Finish color as selected by Architect. The word "fire" shall appear on the grill minimum ½-inch letters. The grill shall be attached with screws to the box.
4. Each audible notification visual devices shall incorporate a visual alarm indicator. The visual alarm indicating device shall be an integral part of the audible alarm box assembly.
5. Audible notification device and visual notification devices shall be connected to separate notification alarm signal circuits. Do not connect these devices to the same circuit conductors.

B. Notification Appliances

1. Speakers

Low Profile Speaker

Provide low profile wall mount speakers at the locations shown on the Drawings. The low profile speaker shall not extend more than 1-inch (2.5cm) past the finished wall surface and provide a switch selectable audible output of 2w (90dBA), 1w (87dBA), ½w (84dBA), or ¼w (81dBA) at 10 feet when measured in reverberation room per UL-464.

Wattage setting shall be visible with the cover installed. When the cover is installed, no mounting hardware shall be visible. In and out screw terminals shall be provided for all wiring. The low profile speaker shall mount in a North American 4-inches x 2⅛-inches square electrical box, without trims or extension rings.

2. Speaker-Ceiling Mount-8-inch

Provide 8-inches ceiling mounted speakers at the locations shown on the Drawings. In and out screw terminals shall be provided for wiring. Speaker baffles shall be round or square steel with white finish as required. Provide square surface mount boxes with matching finish where required. Speakers shall provide ½w, 1w, 2w, and 4w power taps for use with 25V or 70V systems. At the 4 watt setting, the speaker shall provide a 94-dBA sound output a frequency of 1000Hz when measured in an anechoic chamber at 10 feet.

3. Speaker-Cone-4-inch

Provide 4-inches white speakers at the locations shown on the Drawings. Speakers shall have a 4-inch Mylar cone, paper cones are not acceptable. The rear of the speakers shall be completely sealed protecting the cone during and after installation. In and out screw terminals shall be provided for wiring. Speakers shall provide ¼w, ½w, 1w, and 2w power taps for use with 25V or 70V systems. At the 2-watt setting, the speaker shall provide a 90-dBA sound output over a frequency range of 400-4000Hz when measured in reverberation room per UL-1480.

4. Speaker-Reentrant Surface

Provide 4-inch surface re-entrant speakers at the locations shown on the Drawings. Speakers shall provide 2w, 4w, 8w, and 15w power taps for use with 25V or 70V systems. The re-entrant speakers shall utilize a high efficiency compression drivers. Cone type drivers are not acceptable. At the 15 watt setting, the speaker shall provide a 102 dBA sound output over a frequency range of 400-4000Hz when measured in reverberation room per UL-1480. Weatherproof boxes shall be provided for out-door mounting.

5. Speaker-Strobes

Low Profile Speaker-Strobe

Provide low profile wall mount speaker/strobes at the locations shown on the Drawings. The low profile speaker/strobe shall not extend more than 1-inch (2.5cm) past the finished wall surface, and provide a switch selectable audible output of 2W (90dBA), 1w (87dBA), ½w (84dBA), or ¼w (81dBA) at 10 feet when measured in reverberation room per UL-464.

Strobes shall provide synchronized flash output that shall be switch selectable for output values of 15cd, 30cd, 75cd and 110cd. Wattage and candela settings shall be visible with the cover installed. When the cover is installed, no mounting hardware shall be visible. In and out screw terminals shall be provided for all wiring. The low profile speaker/strobes shall mount in a North American 4-inches x 2⅛-inches square electrical box, without trims or extension rings.

6. Speaker-Strobe 4-inch

Provide 4-inches red speakers/strobes at the locations shown on the Drawings. Speakers shall have a 4-inches Mylar cone, paper cones are not acceptable. The rear of the speakers shall be completely sealed protecting the cone during and after installation. In and out screw terminals shall be provided for wiring. Speakers shall provide ¼w, ½w, 1w, and 2w power taps for use with 25V or 70V systems. At the 2 watt setting, the speaker shall provide an 87 dBA sound output over a frequency range of 400-4000Hz when measured in reverberation room per UL-1480. Strobes shall provide synchronized flash. Strobe output shall be determined as required by its specific location and application from a family of 15/75cd, 30cd, and 110cd devices.

7. Speaker-Strobe Ceiling 8-inch

Provide 8-inches ceiling mounted speaker/strobes at the locations shown on the Drawings. In and out screw terminals shall be provided for wiring. Speaker baffles shall be round or square, steel with white finish as required. Provide square surface mount boxes with matching white finish as required. Speakers shall provide ½w, 1w, 2w, and 4w power taps for use with 25V or 70V systems. At the 4 watt setting, the speaker shall provide a 94 dBA sound output a frequency of 1000Hz when measured in an anechoic chamber at 10 feet. Strobes shall provide synchronized flash outputs. Strobe output shall be determined as required by its specific location and application from a family of 15cd, 30cd, 75cd, and 110cd devices.

8. Speaker-Strobe Re-entrant

Provide 4-inch red re-entrant speaker/strobes at the locations shown on the Drawings. Weatherproof boxes shall be provided for outdoor mounting. Speakers shall provide 2w, 4w, 8w, and 15w power taps for use with 25V or 70V systems. The re-entrant speakers shall utilize a high efficiency compression drivers. Cone type drivers are not acceptable. At the 15-watt setting, the speaker shall provide a 102 dBA sound output over a frequency range of 400-4000Hz when measured in reverberation room per UL-1480. Strobes shall provide synchronized flash. Strobe output shall be determined as required by its specific location and application from a family of 15cd, 30cd, 75cd, and 110cd devices.

C. Visual Alarm Indicator

1. Lamp/Strobe internally illuminated projecting lens assembly, with flasher system. Unit shall flash on and off to provide visual indicating of fire alarm.
2. The word "fire" shall appear on the lens or lens plate.
3. Flash rate, one flash per second, with a flash duration of approximately 0.001 second, flash rate independent of audible device.
4. Light source, Xenon high intensity flash strobe tube white/clear color.
5. Strobe shall have a minimum output of 75 candelas with a maximum flash intensity of 120 candelas.
6. Strobe shall comply with NFPA Requirements.

2.7 REMOTE FIRE ALARM ANNUNCIATOR

A. General

1. The annunciator panel shall be powered and operated from the fire alarm control panel. "In-out" circuit conductors shall terminate on numbered screw-type terminals.
2. A metal tamper resistant weatherproof cabinet shall contain the annunciator components. The panel shall be surface or flush mounted as indicated on the Drawings. Provide a full height tamper resistant, hinged locking cabinet door. Door shall have transparent high impact windows to allow visual observation of all indicators and switches.

3. An electronic digital, multiplex, addressable module shall be incorporated into the annunciator. The module shall communicate the status and trouble condition of each device with a unique address code. The module shall communicate with and be super-vised and monitored by the fire alarm control panel.

B. Each Alarm Initiating Zone (including spares) shall be individually annunciated in the annunciator panel.

C. A Common Fire Trouble Alarm shall be annunciated in the annunciator panel from the fire alarm control panel.

D. Annunciator Lamp Circuits shall be automatically supervised. Provide lamp test switch in the annunciator panel.

E. An Audible Alarm/Trouble Buzzer with silence switch and automatic resound for subsequent alarm/trouble signals shall be provided. The annunciator panel shall be automatically reset when the control panel is reset.

F. A Keyed Switch shall be provided for remote reset of the system. The annunciation panel shall also be automatically reset when the control panel is reset.

G. Provide a Floor Plan of the facility framed under acrylic and mounted adjacent to the fire alarm annunciator. The Floor Plan shall be to scale and shall have room numbers clearly displayed on all rooms corresponding to the annunciator for the purpose of easily identifying the fire zones.

2.8 REMOTE EQUIPMENT MONITORING AND CONTROL

A. An Electronic Digital Multiplex addressable module shall be provided at each device or equipment indicated to be controlled by the multiplex system. Multiple addressable control ports shall be provided in each module quantity as required for each point controlled or monitored. The module shall communicate the monitor status control action and trouble condition of each device with a unique address code. The module shall communicate with and be supervised and monitored by the fire alarm control panel.

B. Where multiple points are monitored or controlled, provide digital, multiplex, Multi-points, Monitor, Control Panel (MMCP). The panel cabinet shall be self-contained NEMA 1 construction and hinged locking door. Provide tamper switch detection zone on the cabinet door; provide 60 hour battery UPS backup and power supply, the same as required for the fire alarm control panel. Panel shall be expandable using plug-in circuit monitor/control printed circuit cards. Provide barriered numbered terminal strips.

C. Each Control Point shall provide a supervised "dry" relay contact single pole double throw maintained contact rated 10-amp, 227 volt, 60Hz AC.

D. Each monitor point shall provide not less than one of the following supervised methods of monitoring a remote device or equipment action or status.

1. Remote "dry" contact operation normal open, normally closed or momentary contact operation.

PART 3 - EXECUTION

3.1 IDENTIFICATION

A. The inside cover of alarm initiating devices shall be marked with the zone initiating number corresponding to the zone number in the control panel. Marking shall be with a felt-tip pen.

B. Each fire alarm terminal cabinet shall be painted red.

C. Provide nameplate: "Power to Main Fire Alarm Control Panel" screwed onto the branch circuit overcurrent device supplying power to the main fire alarm control panel.

3.2 WIRING

A. Review the total system point-to-point wiring layout to assure that the correct number and type of wires and conduit sizes are installed.

B. Final connections, testing, adjusting and calibration shall be made under the direct supervision of a Factory-Trained Technician of the System Supplier.

C. All wiring shall be in conduit.

D. All wiring in cabinets shall be neatly formed, laced and made up on bolt and nut terminal blocks. Tag all spare conductors. All conductors shall terminate on terminal strips with spade lugs, of adequate size for all incoming and outgoing conductors. The strips shall be labeled as to their use and wiring diagram shall be placed on the cabinet door showing connections of all related equipment to these strips.

E. Wiring Requirements for shielding certain conductors shall be as recommended by the Manufacturer. Provide all conduit, raceways and conductors per Manufacturers recommendations and include all material and labor costs in the Contract price.

F. The conductors used for digital, multiplex communication between the fire alarm control panel and external remote initiation devices, control points and annunciators, shall be twisted, shielded, multi-conductor cable, #16AWG copper minimum with a separate internal ground/ drain conductor, UL listed for fire alarm system use. One spare pair of multiplex conductors shall be provided in all main and branch device/equipment connections for future system use. "Tees" and taps at any junction box location in the communication lines, shall be permitted by the system to additional devices without affecting proper system operation.

G. Wire Size: Wire shall be sized to insure installed circuit voltage drop does not exceed 10% to all devices.

3.3 OUTLET BOXES

Device outlet boxes shall be flush mounted unless indicated otherwise on the Drawings. Provide extension rings to finish flush with finish surface. Where the Drawings indicate surface mounted devices, outlet boxes shall be cast metal with threaded hubs. Where the conduit entrances are not exposed for surface mounted devices, provide flush outlet box behind the device box, and omit the conduit hubs on the device box. Size device boxes and outlet boxes per Manufacturer’s recommendation and as required by Code for wire fills.

3.4 SPECIAL INSTALLATION REQUIREMENTS

A. Air duct smoke detectors shall be installed in the supply air ducts and return air ducts with an air flow of 2000 CFM or greater, coordinate with Mechanical Contractor. Sampling tube shall extend across entire duct width. Provide ¾-inch conduit with 2#12 to respective motor control device to automatically shut down the respective fan motor upon detection of smoke in the air duct. Installation shall be in compliance with CMC 606.8.

B. Water flow switches shall be installed on each main fire sprinkler rise pipe, coordinate with the Fire Sprinkler Contractor.

C. Tamper switches shall be installed on each main fire sprinkler shut-off valve, coordinate with the Fire Sprinkler Contractor.

D. Equipment shall be weatherproof gasketed where installed in locations exterior to the building, or where indicated on the Drawings. Weatherproof equipment shall be tamper resistant.

E. Provide clear vandal resistant protective cover for all audio-visual devices located in student restrooms and public hallways.

F. Provide wire guard for ceiling mounted smoke and heat detectors located in student restrooms.

G. Connect fire alarm control panel with security/intrusion control panel for monitoring by Remote Monitoring Company.

H. Connect fire alarm control panel with master clock system to turn off class passing schedule, with paging system to turn off system when fire alarm system in alarm condition.

I. Conduit with fire alarm wiring shall be painted red.

J. Fire alarm system shall be programmed per actual building and room designation. Submit printout for review.

3.5 TESTING

A. The Entire Fire Alarm System shall be tested in the presence of the Local DSA Inspector and a Representative of the Manufacturer after the installation is complete.

1. Individually activate each manual initiating station and verify correct alarm operation and control panel response.
2. Individually test each automatic initiating device and verify correct alarm operation, control panel response and remote equipment operation.
3. The communication loops and the notification alarm circuits shall be opened in at least two locations per building to check for the presence of correct supervisory circuitry.

B. Test the battery back-up system by disconnecting the incoming normal power and allowing this alarm system to operate 24 hours on battery power. Sound the alarm system for 5-minutes at the end of 24 hours on battery power.

C. Perform all electrical and mechanical tests required by the Equipment Manufacturer's certification form. Measure and adjust each automatic detection detector to the maximum stable sensitivity setting. Detector tests shall be performed with the detector at its operational location and under normal operational environmental

conditions in the area. Bench settings are not acceptable. An operational check-out test and report shall be performed. Submit six copies of test report results. The tests and report shall include, but not be limited to:

1. A complete list of equipment installed and wired.
2. Indication that all equipment is properly installed and functions and conforms with these Specifications.
3. Test of individual zones as applicable.
4. Serial numbers locations by zone and model number for each installed detector.
5. Voltage (sensitivity) settings for each ionization and photoelectric detector as measured in place with the HVAC system operating.
6. Technician's name, certificate number and date.
7. The completed manual and automatic monitoring and control system shall be tested to insure that it is operating properly. This test will consist of exposing the installed units to a standard fire test.
8. Acceptance of the system shall also require a demonstration of the stability of the system. This shall be adequately demonstrated if the system operates for a 90-day test period without any unwarranted alarms. Should an unwarranted alarm(s) occur, the Contractor shall readjust or replace the equipment and detector(s) and begin another 90-day test period. As required by the Architect, the Contractor shall recheck the detectors using the fire test after each readjustment or replacement of detectors. This test shall not start until the District has obtained beneficial use of the building under tests.

D. After the testing has been completed to the satisfaction of CFC 904(a) – 904.2(f) the Inspectors, provide the NFPA certificate of compliance to the District, the Local Fire Official, the Architect and DSA.

E. Upon the receipt of Certificate of Compliance, the Installer/Supplier shall supply the District with a written Operating, Testing and Maintenance Instructions, Point-To-Point As-Built Drawings and Equipment Specifications. Maintenance provisions, CFC 904(a) – 904.2(f).

3.6 INSTRUCTIONAL SESSIONS

Provide a 2-hour instructional sessions conducted by a Factory-Authorized Technician at the job site after completion of all tests to instruct District Personnel on the use of the system. The first session shall be videotaped and conducted prior to final acceptance of the Project. The second session shall be held within eleven months of final acceptance of the Project, when requested by the District.

END OF SECTION 284620
040119/212227

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.01 SUMMARY

A. Contractor shall furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all site clearing work as required and as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

B. Removal of surface debris; removal of paving and curbs; removal of trees, shrubs, and other plant life; topsoil excavation; and repair of damaged vegetation and/or irrigation systems/system components.

C. Removal of concrete and bituminous surfacing.

1.02 RELATED SECTIONS

A. Section 312000: Earthwork.

1.03 REFERENCE STANDARDS

A. The work provided herein shall conform to and be in accordance with the Contract Plans, General Conditions/Specifications and Special Provisions, as well as the Standard Specifications for Public Works Construction ("GREENBOOK"), 2015 Edition, adopted by the Southern California Chapter, American Public Works Association; herein referred to as the "Standard Specifications".

1.04 REGULATORY REQUIREMENTS

A. The Contractor shall obtain all necessary permits, licenses, or agreements required by any legally constituted agency, pay for all fees and give all necessary notices required for the construction of the work. The Owner shall reimburse the contractor for all necessary permits or inspection fees by any legally constituted agency.

B. Perform all work of this Section in strict accordance with applicable Government Codes and Regulations especially meeting all safety standards and requirements of CAL/OSHA, County of Los Angeles and the City of Compton. Provide additional measures, added materials and devices as may be needed as directed by the District Representative at no added cost to the District.

C. Comply strictly to Rule 1404, South Coast Air Quality Management District.

B. Coordinate clearing Work with utility companies.

PART 2 – PRODUCTS

2.01 Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Section 31 20 00 – Earthwork.

A. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verify that existing plant life designated to remain is tagged or identified.

B. Identify a waste area for placing removed materials.

3.02 PROTECTION

A. Protect existing structures and site improvements indicated to remain, from damage by approved methods and/or as authorized by the District Representative. Removal of all protections shall be when work of this Section is completed or when so authorized by the District Representative.

B. Protect Existing Utilities indicated or made known to remain traversing the job-site and serving existing adjacent facilities.

C. Protect Existing Trees and Shrubs indicated to remain by providing temporary surrounding fencing so located a sufficient distance away so that trees and shrubs will not be damaged by site-clearing operations.

1. Protection Barrier: A protection barrier shall be installed around the shrubs or trees to be preserved. The barrier shall be constructed of a durable fencing material, such as plastic construction fencing, snow fence, or chain link. The barrier shall be placed at or beyond the drip line. "Drip line" as referred to herein means a line which may be drawn on the ground around the tree directly under its outermost branch tips and which identifies that location where rainwater tends to drip from the tree. Placement of barrier to be approved by District Representative (Grounds Supervisor). If barrier is placed inside the drip line, then 3/4 inch plywood must be placed over the root zone up to the drip line. The fencing shall be maintained in good repair throughout the duration of the project, and shall not be removed, relocated, or encroached upon without permission of the District Representative (Grounds Supervisor).

2. Storage of Materials: There shall be NO storage of materials or supplies of any kind within the area of the protection barriers. Concrete, cement, asphalt materials, block, stone, sand and soil shall not be placed within the drip line of the tree(s).

3. Fuel Storage: Fuel storage shall NOT be permitted within 150 feet of any tree to be preserved. Refueling, servicing and maintenance of equipment and machinery shall NOT be permitted within 150 feet of protected trees.

4. Vehicles/equipment: NO parking or driving of vehicles or storage of equipment shall be permitted within the drip line of any tree to be preserved.

5. Debris and Waste Materials: Debris and waste from construction or other activities shall NOT be permitted within protected areas. Wash down of Concrete, cement or asphalt handling equipment, in particular shall NOT be permitted within 150 feet of protected areas.

6. Grade Changes: Grade changes can be particularly damaging to trees. Any grade changes should be approved by the District Representative (Grounds Supervisor) before construction begins and precautions taken to mitigate potential injuries.

7. Damages: Any damages or injuries to the preserved trees (including pruning or cutting of such trees not in conformity with the International Society of Arboricultural Pruning

Guidelines and ANSI A300 Pruning Standards) shall be reported immediately to the District Representative (Grounds Supervisor). Severed roots shall be pruned cleanly to healthy tissue, using proper pruning tools. Broken branches/limbs shall be pruned according to International Society of Arboricultural Pruning Guidelines and ANSI A300 Pruning Standards. In the event that any damage, injury, improper pruning or cutting of a protected tree is deemed to be so substantial as to require its replacement (such determination to be made in the sole discretion of the District Representative), Contractor shall replace such tree with the same species and variety of tree, up to a box size of 48 inches, or if no such replacement is available, with a substitute species or variety as determined in the sole discretion of the District Representative. Any replacement tree shall be approved in advance by the District Representative. The value of the tree to be replaced shall be determined by a Certified Arborist selected by Contractor from the District's approved list of Registered Consulting Arborists. To the extent that the value of the replaced tree as determined by the Certified Arborist exceeds the cost of the replacement tree, Contractor shall be liable to District for such difference in value in addition to all costs associated with replacement of the damaged tree.

8. Removal of Existing Tree or Shrub: Prior to removing or cutting any trees designated for removal, the contractor shall coordinate with the District's Ground Supervisor. In the event that Contractor, a Subcontractor, Sub-Subcontractor, material supplier or anyone else performing the Work of the Contract willfully, negligently or mistakenly removes any tree or shrub not designated for removal, Contractor shall immediately report such removal to the District Representative (Grounds Supervisor). Contractor shall replace such tree with the same species and variety of tree, up to a box size of 48 inches, or if no such replacement is available, with a substitute species or variety as determined in the sole discretion of the District Representative. Any replacement tree shall be approved in advance by the District Representative. The value of the tree to be replaced shall be determined by a Certified Arborist selected by Contractor from the District's approved list of Registered Consulting Arborists. To the extent that the value of the replaced tree as determined by the Certified Arborist exceeds the cost of the replacement tree, Contractor shall be liable to District for such difference in value in addition to all costs associated with replacement of the damaged tree.

9. Unauthorized Tree Removal or Injury: Criminal Penalties: Reference is made to California Penal Code §384a which provides that any person who willfully or negligently cuts, destroys, mutilates or removes any tree or shrub or portion thereof growing on public land without a written permit from the owner of said public land is guilty of a misdemeanor, subject to a fine of up to $1,000, imprisonment in county jail for up to 6 months, or both. Contractor is advised that, in addition to all remedies provided herein and in the Contract Documents, the District shall cooperate with appropriate authorities in prosecuting and enforcing Penal Code §384a and other criminal sanctions as appropriate concerning trees and shrubs located on District property.

10. Preventive Measures: Before construction begins fertilization of the affected areas to be applied at a rate to be determined by the District Representative (Grounds Supervisor).

D. Protect bench marks, survey control points, and existing structures from damage or displacement.

E. Protection of Persons and Property (existing structures and site improvements):

1. Provide barricades, warning signs at open depressions and holes on adjacent property and public accesses.

2. Provide operating warning lights during hours from dusk to dawn each day or as otherwise required.

3. Protect existing remaining structures, utilities, sidewalks, pavements other facilities from damage as caused by settlement, undermining, washout or other hazards created by site-clearing operations of this Section.

F. Use means necessary to prevent dust from becoming a nuisance to the public, to neighbors and to others performing work on or near the job-site.

G. Maintain access to the job-site at all times.

3.03 CLEARING

A. Clear areas required for access to site and execution of Work.

B. Remove all rubbish and debris existing and resulting from work operations of this Section as soon as possible, do not allow to pile up. Do not burn rubbish and debris on the job-site.

C. Where active utility lines need to be capped or plugged, perform such work in accordance with requirements of the Utility Company.

3.04 REMOVAL

A. Remove debris, rock, and extracted plant life from site.

B. Excavate and remove associated plumbing piping.

C. Prior to demolition work, the Contractor shall notify the District Representative to identify the existing items for salvage purposes. The materials identified for salvage shall be returned to the District in a timely manner agreed upon by the District Representative.

3.05 CONCRETE AND BITUMINOUS SURFACE REMOVAL

A. Where noted on the construction drawings, break up and completely remove all existing concrete surfacing, curbs, gutters, walks and bituminous surfacing to limits indicated to be removed. All cutting shall be done to a neat and even line with proper tools or a concrete cutting saw. Minimum depth of cut shall be 1-1/2”, unless otherwise specified. Remove any concrete broken beyond the indicated limits to the nearest joint or score line and replace with new concrete to match the existing.

B. Removed concrete and bituminous materials shall be disposed of off-site unless otherwise noted on the construction drawings. All such items to be removed shall be disposed of off the property in a legal manner.

C. Bituminous pavement saw cutting shall conform to the provisions of Section 300-1.3.2 (a) of the Standard Specifications. The residue resulting from the saw cutting operations shall not be permitted to flow beyond the specific work location and shall be removed the same day.

D. Removal of concrete curb / curb & gutter covered by this section shall include saw-cutting and removal of a twelve (12") inch wide section of the adjacent bituminous pavement.

E. When saw cutting concrete curb / curb & gutter, the cuttings shall be continuously wet vacuumed to prevent the materials from entering catch basins, storm water conveyances, or waters of the State. Vacuumed cuttings shall be disposed of according to applicable regulations.

F. Concrete curb and concrete curb and gutter shall be removed to the lines, grades and locations shown on the plans in accordance with Section 300-1.3.2 of the Standard Specifications.

G. Concrete removal in sidewalk and driveway areas shall extend to existing score lines unless specifically indicated otherwise on the Plans or in the Project Special Provisions, or unless otherwise approved by the Engineer.

H. Reinforcing or other steel may be encountered in portions of concrete to be removed. No additional compensation will be allowed for the removal of concrete containing reinforcing or other steel.

I. In those areas where existing bituminous surfacing is removed to make way for new planting or lawn areas, remove soil 6” below existing exposed soil surface. Removed soil may be used only as fill under buildings or other areas to be paved, only if approved by the District Inspector. Legally dispose of off site, if material is not approved as fill material.

3.06 REPAIRS

A. During demolition and construction, ensure that trees, shrubs and other plant material and vegetation are protected inside and outside of the work zone and that the vegetation is being watered, maintaining the proper moisture content according to the season. Failed vegetation, including sod, due to lack of water, and/or plant material destroyed during construction period are to be replaced to equal or better size and condition at no additional cost to the District.

B. If the irrigation system is damaged or modified during construction, it shall be repaired to the Districts standards, and shall be in equal or better condition than prior to damage or modification. All repairs shall be, inspected and approved by the District Representative (Grounds Supervisor) prior to backfilling or covering of said repairs. The District representative requires forty-eight hours prior notice, when contractor requests inspection of completed repairs. All repairs shall be made so as to ensure proper operation prior to the close of the contract at no additional cost to the District.

C. Controller Wires: If damaged, cut or removed, repair by splicing, soldering and silicone sealing. To ensure proper operation, reconnect the wires to the valve to correspond with the map on the controller to the correct station.

D. Hydraulic Tubes: If damaged/cut or removed, repair by replacing the tubing using equal or better material.

E. Valves: If damaged, repair/replace with equal or better material. All valves are to be flushed/cleaned thoroughly.

F. Mainlines: If damaged, repair/replace with equal or better material. All lines are to be flushed/cleaned thoroughly.

G. Lateral Lines: If damaged, repair/replace with equal or better material. All lines are to be flushed/cleaned thoroughly.

H. Irrigation Heads: If damaged, repair/replace with equal or better material. All heads are to be flushed and filters cleaned thoroughly.

I. Controllers: If damaged repair/replace with equal or better material.

J. Backflow Prevention Devices: If damaged, repair/replace with equal or better material.

K. Gate/Ball/Quick Coupler Valves: If damaged repair/replace with equal or better material.

L. Valve Boxes: If damaged, repair/replace with equal or better material. Concrete boxes and concrete lids with the appropriate markings for identification shall be used. The top of the box shall be buried below finish grade, equal to existing depth or deeper. The top of the valve stems shall be 6" below the underside of the top of the box.

M. Construction in grass areas: Sod shall be removed by sod cutting at a soil depth of 2", stored on site, and watered on a daily basis. Upon completion of work, stored sod shall be reinstalled over the areas disrupted due to construction. An option may be to bypass cutting the sod, however at the completion of the project, finish grading and installation of new Hybrid Bermuda GN -1 sod over the areas disrupted by construction shall be required.

3.07 EXCESS MATERIALS DISPOSAL

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off Owner's property.

3.08 SITE CLEANUP

A. Cleanup of branches, limbs, logs, or any other debris resulting from any operations shall be promptly and properly accomplished. The work area shall be kept safe at all times until all operations are completed. Under no circumstances shall the accumulation of brush, limbs, logs, or other debris be allowed in such a manner as to result in a hazard to the public. All debris shall be cleaned up each day before the work clew leaves the site, unless permission is given by the Owner to do otherwise. All lawn areas shall be raked, all streets and sidewalks shall be swept, and all brush, branches, rocks or other debris shall be removed from the site. Areas are to be left in a condition equal to or better than that which existed prior to the commencement of operations.

END OF SECTION 301000

SECTION 312000 - EARTHWORK

PART 1 - GENERAL

1.01 SUMMARY

A. The work of this section shall include excavation, unclassified cut, unclassified fill, removing existing unsatisfactory material, preparing areas to be filled, spreading and compacting of fill in the areas to be filled, and all other work necessary to complete the grading of the site. It shall be the Contractor's responsibility to place, spread, moisten or dry, and compact the fill in strict accordance with these specifications to the lines and grades indicated on project plans or as directed in writing by the Geotechnical Engineer. Included with this Work are the following:

1. General exterior grading, cutting and filling, including grading for building area, paving, planting areas, banks and hillsides.

2. Excavating, filling, backfilling, and compacting for Project site pavement, planting areas, buildings, and other structures.

3. Subgrade preparation for hardscape.

4. Excavating and backfilling trenches.

5. Shoring plan guidelines.

B. Related Sections: The following Sections contain requirements that relate to this Section.

1. Section 01 31 32 - Import Materials Testing.

2. Section 01 71 23 – Field Engineering.

3. Section 32 12 16 - Asphalt Paving.

4. Section 32 13 13 - Cement Concrete Pavement.

5. Owner provided Geotechnical Report.

1.02 DEFINITIONS

A. Excavation consists of the removal of material encountered to subgrade elevations and the reuse or disposal of materials removed.

B. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

C. Borrow: Soil material obtained off site when sufficient approved soil material is not available from excavations.

D. Base Course: The layer placed between the subgrade and surface pavement in a paving system.

E. Drainage Fill: Course of washed granular material supporting slab on grade placed to cut off upward capillary flow of pore water.

F. Permeable Backfill: Provide permeable backfill material behind retaining structures consisting of gravel, crushed gravel, crushed rock, natural sands, manufactured sand, or combinations.

G. Unauthorized excavation consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the Architect. Unauthorized excavation, as well as remedial work directed by the Architect, shall be at the Contractor's expense.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man made stationary features constructed above or below ground surface.

I. Utilities include underground pipes, conduits, ducts, and cables, as well as underground services within building lines.

1.03 SUBMITTALS TO CONSTRUCTION MANAGER

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Imported Soils: CONTRACTOR shall provide the services of a licensed environmental professional (licensed State of California Professional Engineer [PE Civil], Registered Geologist [RG] or Registered Environmental Assessor II [REA II]) familiar with environmental site assessment and waste classification and disposal requirements. The CONTRACTOR shall provide an independent approved California Department of Health Services certified testing laboratory, to perform sampling and testing of imported fill materials in accordance with the terms as specified in Section 01 31 32: Import Materials Testing.

1. Testing laboratory must be pre-approved by the Division of State Architect.

C. Product data for the following:

1. Each type of plastic warning tape.

2. Filter fabric.

D. Samples of the following:

1. 12 by 12 inch sample of filter fabric.

E. Test Reports: In addition to test reports required under field quality control, submit the following:

1. One optimum moisture-maximum density curve for each soil sample.

2. Laboratory analysis of each soil material proposed for fill or backfill from borrow sources.

F. Excavation support & protection (shoring) shop drawings for informational purposes: Prepared by or under the supervision of a qualified professional engineer for excavation support and protection systems.

1.04 QUALITY ASSURANCE

A. Codes and Standards:

1. 2016 California Building Code, Title 24, Part 2, Volume 2 of 2, Appendix J, Grading.

2. ASTM D422 - Method for Particle Size Analysis of Soils

3. ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.

4. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54 kg) and 18-inch (457-mm) Drop.

5. ASTM D2216 - Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil Aggregate Mixtures.

6. ASTM D2922 - Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depths).

7. ASTM D3017 - Test Method for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depths).

8. ASTM D4318 - Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

9. AASHTO T217 - Determination of Moisture in Soils by Means of a Calcium Carbide Gas Pressure Meter.

10. ASTM D4829 - Expansion Index Test.

B. Conditions/Specifications and Special Provisions, as well as the Standard Specifications for Public Works Construction ("GREENBOOK"), 2015 Edition, adopted by the Southern California Chapter, American Public Works Association; herein referred to as the "Standard Specifications".

C. Sampling, testing, and certification of imported soils shall be performed in accordance with Section 01 31 32 - Import Materials Testing.

D. Comply with all requirements of permit for export of soil from site. Permit is to be obtained and paid for by Contractor. Furnish copies of all permits and licenses required by the City of Compton to Owner's representative.

E. Professional Observation: A soils engineer will be retained by the Owner for purposes of inspection, testing and approval of all work under this section. Perform work of this Section under inspection and approval of the soils engineer. Give soils engineer not less than 48 hours advance notice of readiness for inspection.

F. The soils engineer will have the authority over all filling, grading, and compaction operations, including interruption of work if deemed necessary due to improper work

G. Pre-Grading Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."

1. Before commencing earthwork operations, meet with representatives of the governing authorities, Owner, Architect, consultants, Geotechnical Engineer, independent testing agency, and other concerned entities. Review earthwork procedures and responsibilities including testing and inspection procedures and requirements. Notify participants at least 3 working days prior to convening conference. Record discussions and agreements and furnish a copy to each participant.

1.05 CONSTRUCTION MONITORING

A. All earthwork and foundation construction should be monitored by a qualified engineer/technician under the supervision of a Geotechnical Engineer, including;

1. Observation of all site preparations;

2. Observation of shoring installation, if needed:

3. Observation of all site excavations;

4. Test and approval of all import soil;

5. Observation of placement of all compacted fills and backfills;

6. Observation of all surface and subsurface drainage systems;

7. Observation of all foundation and pile excavations;

8. Observation of subgrade preparation for paved and building areas.

B. The Geotechnical Engineer of Record should be notified at least three (3) days in advance of the start of construction. A joint meeting between the Contractor and Geotechnical Engineer is recommended prior to the start of construction to discuss specific procedures and scheduling. The Geotechnical Engineer should be present to observe the soil conditions encountered during construction, to evaluate the applicability of the recommendations presented in the Soils Report to the soil conditions encountered, and to recommend appropriate changes in design or construction if conditions differ from those described herein. The Geotechnical Engineer of Record should inspect and approval all imported backfill material prior to its placement as backfill, approve the subgrade beneath all fills, fill placement and bottom of all foundation excavations before concrete or steel is placed.

C. The Geotechnical Engineer shall submit compaction reports to the Construction Manager and the Civil Engineer at the completion of the work, including test results and plot plans indicating the locations from which the tested samples of fill were taken. The Geotechnical Engineer shall keep the Construction Manager informed on the progress of the grading work.

1.06 IMPORT AND EXPORT OF EARTH MATERIALS

A. Fees: Pay as required by government authority having jurisdiction over the area.

B. Bonds: Post as required by government authority having jurisdiction over the area.

C. Hauling Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.

1.07 TRUCK HAUL ROUTE

A. A proposed truck haul route is to be submitted to the City of Compton Public Works for review and approval. Upon approval, an approved copy shall be returned to the Contractor. The Contractor shall post an approved copy on the job site. All trucks working that project shall also carry a copy. If a truck(s) is found not to be carrying an approved copy, the Contractor shall be subject to a Notice of Noncompliance (stop work order)

B. All trucks must cover their dirt with an acceptable tarp during transport for dust containment. Provisions for street sweeping and watering will also be required unless an active wheel washing facility proves that they are un-necessary to the satisfaction of the Engineer.

C. All truck haul routes, as approved, are good only for the project time period, and trucks shall have to comply with the approved route only. If during the progress of the project an alternate route is needed, the Contractor shall submit a new plan. The haul route application shall contain the following information:

1. Map showing the proposed route
2. Project name
3. Grading Contractor's name, address and phone number
4. Type of material being hauled
5. Encroachment or construction permit number

1.08 DIG ALERT NOTIFICATION

A. Before any excavation in or near the public right-of-way, the Contractor must contact the Underground Service Alert of Southern California (Dig Alert) at **811** for information on buried utilities and pipelines.

B. Delineation of the proposed excavation site is mandatory. Mark the area to be excavated with water soluble or chalk based white paint on paved surfaces or with other suitable markings such as flags or stakes on unpaved areas.

C. Call at least Two (2) full working days prior to digging.

D. If the members (utility companies) have facilities within the work area, they will mark them prior to the start of your excavation and if not, they will let you know there is no conflict. A different color is used for each utility type (electricity is marked in red, gas in yellow, water in blue, sewer in green, telephone and cable TV in orange).

E. The Law requires you to hand expose to the point of no conflict 24" (inches) on either side of the underground facility, so you know its exact location before using power equipment.

F. If caught digging without a Dig Alert ticket you can be fined as much as $50,000 per California government code 4216.

1.09 SUBSURFACE CONDITIONS

A. Where investigations of subsurface conditions have been made by the Owner with respect to subsurface conditions, utilities, foundation, or other structural designs, and that information is shown in the Plans, it represents only a statement by the Owner as to the character of materials which have actually been encountered by the Owner's investigation. This information is only included for the convenience of Bidders.

B. Investigations of subsurface conditions are made for the purpose of design only. The Owner assumes no responsibility with respect to the sufficiency or accuracy of borings or of the log of test borings or other preliminary investigations or of the interpretation thereof. There is no guaranty, either expressed or implied, that the conditions indicated are representative of those existing throughout the Work, or any part of it, or that unanticipated conditions may not occur. When a log of test borings is included in the Plans, it is expressly understood and agreed that said log of test borings does not constitute a part of the Contract. The log of test borings represents only an opinion of the Owner as to the character of the materials to be encountered, and is included in the Plans only for the convenience of the Bidders. Making information available to Bidders is not to be construed in any way as a waiver of the provisions of the first paragraph of this Section, and Bidders must satisfy themselves through their own investigations as to conditions to be encountered

1.10 PROJECT CONDITIONS

A. Data: Maps, boring logs, geotechnical and foundation investigation reports, and like reference data, not included in Contract Documents but made available to Contractor by Architect or Owner are for information only, and the Architect and Owner assume no responsibility for any conclusions Contractor may draw from such information. Should questions or issues arise, contact Architect or Owner for clarification.

B. Contractor shall determine existing conditions under which the Contractor will operate in performing the Work

C. A geotechnical investigation report no. 10-18020PW has been prepared by United-Heider Inspection Group, dated February 21, 2018 and a supplemental report dated November 2, 2018, for this project. Prior to bidding or performing the work of this project, contractor shall obtain a copy of this report, and shall thoroughly familiarize himself/herself with its contents. Any information obtained from such report, or any information given on any drawings as to subsurface soil conditions or to elevations of existing elevations or elevations of underlying rock, is approximate only, is not guaranteed, and does not form a part of the contract, unless specifically referenced in the Contract Documents. The Contractor is required to make a visual inspection of the Project Premises and must (and is permitted to) make whatever tests the Contractor deems appropriate to determine and assess the underground condition of the soil. No claims for allowances or damages because of the Contractor's negligence or failure in acquainting itself with the conditions of the Project Premises as described herein will be recognized by the Owner.

D. WARNING: OWNER DOES NOT WARRANT THE SOILS AT THE PROJECT SITE. SOILS INVESTIGATION REPORT IS PROVIDED FOR CONTRACTORS INFORMATION ONLY. CONTRACTOR HAS CONDUCTED AN INDEPENDENT INVESTIGATION OF THE PROJECT SITE AND THE SOILS CONDITIONS OF THE SITE. OWNER DOES NOT WARRANT THE SOILS CONDITIONS OF THE SITE AND CONTRACTOR IS FULLY RESPONSIBLE TO ASCERTAIN SITE CONDITIONS FOR THE PURPOSES OF DETERMINING CONSTRUCTION MEANS AND METHODS PRIOR TO COMMENCING CONSTRUCTION. THE SOILS INVESTIGATION REPORT IS NOT A CONTRACT DOCUMENT.

E. Information on Drawings does not constitute a guarantee of accuracy or uniformity of soil conditions over the Project site.

F. Existing utilities: Locate existing underground utilities in all areas of work prior to excavation or commencement of work. If utilities are to remain in place provide adequate means of protection during earthwork operations.

1. Should uncharted, or incorrectly charted piping or other utilities be encountered during excavation, consult Utility Owner immediately for direction. Cooperate with Owner and Utility companies in keeping respective services and facilities in operation. Repair damaged utilities to the satisfaction of Utility Company.

2. Do not interrupt existing utilities serving facilities occupied or used by Owner, or others, except when permitted in writing by Owner's Representative, and then only after acceptable temporary services have been provided.

3. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut off of services if lines are active.

G. Noise and Dust Abatement: Exercise all reasonable and necessary means to abate dust, dirt rising and undue noise. Perform necessary sprinkling and wetting of construction site to allay dust as required by applicable codes and ordinances.

H. Water for Grading: Contractor shall obtain and pay for all water required for his grading operation. This may include, but is not limited to, payment of deposits to utility for construction meter, and payment of all monthly service and water charges. Construction meter shall be in place throughout construction period unless alternative arrangements are made with the City of Compton Water Department to provide construction water for all purposes. Contractor shall be aware of water moratoriums and restrictions, and shall immediately advise Owner of effects on construction schedules.

I. Existing Conditions: Prior to commencing work at site, verify agreement of existing conditions with indicated conditions. Notify Owner's Representative in writing of discrepancies found. Start of work without notification constitutes acceptance of conditions, without cause for extra compensation.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. General: All soils materials to be used throughout the site shall be approved for use by the Geotechnical testing engineer. Provide approved borrow soil materials from off-site when sufficient approved soil materials are not available from excavations.

B. No earthwork analysis has been completed with respect to the volumes of soils to be excavated, placed, or imported in order to provide the finished grades shown on the plans. The Contractor is solely responsible for verifying the earthwork quantities necessary to complete the project.

C. For earthwork volume estimating purposes, an average shrinkage volume of 5 to 10 percent and subsidence of 0.1 foot may be assumed for the surficial soils. These values are estimates only and exclude losses due to removal of vegetation and debris. Actual shrinkage and subsidence will depend on the types of earthmoving equipment used and should be determined during rough grading.

D. Satisfactory Soil Materials: Soils approved by the testing geotechnical engineer and free of rock or gravel larger than 3 inches in any dimension, debris, waste, vegetation and other deleterious matter and as approved by the Geotechnical Engineer. Rocks or hard lumps larger then approximately 3 inches in diameter should be broken into smaller pieces or should be removed from the site. The on-site shallow silty sand is considered non expansive and is suitable for backfilling purposes.

E. Borrow / Imported Fill Material: Soil excavated from site or imported conforming to requirements for fill material.

1. Materials for the fill shall be free from vegetable matter and other deleterious substances, shall not contain rocks or lumps of a greater dimension than is recommended by the geotechnical consultant, and shall be approved by the geotechnical consultant.

2. Soils proposed for import shall be tested pursuant to the requirements of Section 01 31 32: Import Materials Testing, unless a variance has been requested by CONTRACTOR and approved by the OAR prior to the import of the subject materials.

3. Import materials have an expansion index (EI) of less than 21 and should contain sufficient fines (binder material) so as to be relatively impermeable and result in a stable subgrade when compacted. Import soils should be tested and approved by the Geotechnical Consultant prior to importing.

F. Base Course Material For Use Under Asphalt Pavement: Crushed base material shall consist of materials that meet the provisions listed below.

1. Crushed Aggregate Base (CAB) per Section 200-2.2, 3/4" maximum of the Standard Specifications for Public Works Construction (Green Book).

2. Crushed aggregate base (CAB) shall consist of native rock without naturally occurring asbestos or recycled materials. The Contractor shall submit written documentation, which identifies the source, volume, and proposed transport date of the material for review and approval by the Owner's Construction Manager prior to importing the material. A statement on company letterhead from the source, stamped by either a California Professional Geologist or Engineer, which states that the subject materials are native rock, do not contain any recycled materials and that the source does not mine ultramafic materials, a source of natural occurring asbestos shall be included in the submittal to Owner's Construction Manager.

3. Crushed Miscellaneous Base (CMB) per Section 200-2.4, fine sieve, of the Standard Specifications for Public Works Construction (Green Book).

G. Engineered Fill: Satisfactory Soil Materials / Borrow Fill Material, as described above, placed in lifts no greater than 8 inches thick (loose measurements), and compacted to the requirements noted in the project soils report.

H. Bedding Material for Trenches:

1. Bedding sand shall be as defined by Standard Specifications, Section 200-1.5, and shall be free of expansive material and organic matter. On-site soils are not considered suitable for bedding of utilities.

2. Sand providing a sand equivalent of at least 30. All of the sand bedding shall be compacted as indicated in the Contract Documents by mechanical means. Flooding and jetting shall not be permitted without prior written approval from the Geotechnical Engineer. Where sheeting or shoring is used densification of the bedding shall be accomplished after the sheeting or shoring has been removed from the bedding zone, unless the sheeting or shoring is to be cut off or left in place. Pipe bedding material shall be placed in horizontal layers not exceeding (8) eight inches.

I. Backfill Material for Trenches:

1. The on-site soils have been determined to be suitable for being used for backfilling purposes in trenches. Utility trenches should be backfilled with granular materials and mechanically compacted to at least 85% of the maximum dry density of the soils in softscape areas.

2. Below hardscape, a minimum relative compaction of 90% is required in the subgrade.

J. Filter Fabric: Manufacturer's standard nonwoven geotextile fabric of polypropylene geotextiles, "Mirafi 140N" or approved equal.

2.02 ACCESSORIES

A. Detectable Warning Tape: Acid and alkali-resistant polyethylene film metallic warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick minimum, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep.

1. Tape Colors: Provide tape colors to utilities as follows:

a. Red: Fire Water & Electric.

b. Yellow: Gas, oil, steam, and dangerous materials.

c. Orange: Telephone and other communications.

d. Blue: Potable Water systems, with “Caution: Water Line Below.”

e. Green: Sewer systems, with “Caution: Sewer Line Below.”

f. Green: Storm systems, with “Caution; Storm Drain Line Below.”

2.03 EXCAVATION SUPPORT & PROTECTION – SHORING PLAN

A. The CONTRACTOR shall have at the Worksite, copies or suitable extracts of: Construction Safety Orders, Tunnel Safety Orders and General Industry Safety Orders issued by the State Division of Industrial Safety. The CONTRACTOR shall comply with provisions of these and all other applicable laws, ordinances, and regulations.

B. Before excavating any trench 5 feet or more in depth, the CONTRACTOR shall submit a detailed plan to the Owner showing the design of shoring, bracing, sloping, or other revisions to be made for the Workers’ protection from the hazard of caving ground during the excavation of such trench. If the plan varies from the shoring system standards, the plan shall be prepared by a registered Civil Engineer. No excavation shall start until the DISTRICT has accepted the plan and the CONTRACTOR has obtained a permit from the State Division of Industrial Safety. A copy of the permit shall be submitted to the DISTRICT.

C. The INSPECTOR will provide a competent person trench/excavation certification form to the CONTRACTOR. It shall be completely filled out before any worker has access to trench or excavation and returned to the INSPECTOR before the end of the first working day. The CONTRACTOR shall certify by this form the name of the competent person administering the Work, the soil classification, and the type of excavation protective system provided and/or installed.

D. The CONTRACTOR shall completely fence all excavations to provided protection against anyone falling into the excavation and to the satisfaction of the INSPECTOR. The fencing shall be in place at all times except when workers are present and actual construction operations are in progress.

E. The fencing material shall be chain link fabric or welded wire fabric and 6 feet high, constructed according to one of the following:

1. Tensioned fencing material and have top and bottom tension wires securely fastened to driven steel posts or other equally rigid elements at a maximum spacing of 12 feet; or

2. Untensioned fencing materials securely fastened to extended trench shoring elements at a maximum spacing of 8 feet and fastened to continuous top and bottom rails constructed of nominal 2 in x 4 in lumber or equally rigid material. Framed panels with suitable supporting elements fastened together to form a continuous fence may also be used.

F. Payment for performing all work necessary to provide safety measures shall be included in the prices bid for other items of work except where separate bid items for excavation safety are provided, or required by law.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect adjacent property and existing improvements and structures as necessary to prevent undermining, caving of cuts, and miscellaneous damage.

B. Provide cribbing, sheeting, and shoring necessary to safely retain the earth banks and protect excavations and adjoining grades from caving and other damage resulting from excavating together with suitable forms of protection against bodily injury to personnel employed on the work and the general public. Be responsible for the design, installation, and maintenance of required cribbing and shoring and shall meet the approval of the State Division of Industrial Safety and local governing agencies requirements.

C. Utility lines and structures shown shall be protected and treated as indicated. Where work not shown is encountered, report it to the Architect before proceeding with excavation. Encase active lines in sleeves where they pass through concrete; remove inactive lines as directed, and plug the remaining ends. Bear the costs for repairs to damaged or broken utilities and any damages related thereto.

D. Protect existing improvements and adjacent properties from storm damage and flood hazard originating on this project until final acceptance by the Owner. Prevent silt run-off from the limits of work in accordance with governmental requirements.

E. A minimum 6-foot high, temporary chain link fence and gates, (pair 26' wide, minimum) shall be erected prior to any grading operations at the construction limits perimeter. Coordinate the exact location with Architect and Inspector.

3.02 DEWATERING

A. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area. Any water entering an excavation shall be immediately pumped out and the exposed excavation allowed to dry.

B. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

3.03 GRADE STAKES

A. The Contractor’s Surveyor will set grade stakes. The Surveyor shall be a California registered land surveyor or licensed Civil Engineer. The Surveyor shall be hired and paid by the Contractor, and shall be subject to the approval of the District. Contractor shall notify the District at least 48 hours before staking is to be started. The District will determine if work is ready for staking.

B. All work shall conform to the lines, elevations, and grades shown on the Construction Plans. Three consecutive points set on the same slope shall be used together so that any variation from a straight grade can be detected. Any such variation shall be reported to the Engineer. In the absence of such report, the Contractor shall be responsible for any error in the grade of the finished work.

C. Protect and maintain stakes in place until their removal is approved by the District. Grade or location stakes lost or disturbed by Contractor, shall be reset by the Surveyor at the expense of Contractor.

D. Grades for underground conduits will be set at the surface of the ground. The Contractor shall transfer them to the bottom of the trench.

3.04 EXCAVATION

A. Excavation shall conform to the project soils report.

B. Unclassified Excavations: Comply with the Standard Specifications for Public Works Construction, Section 300: "Earthwork", except as modified herein.

C. In preparation for grading, the construction areas should be cleared of surface vegetation, concrete, pavement and any loose surficial soils. Any unsuitable material encountered should be properly disposed of and not incorporated into any new fill.

D. Excavate to the depths, lines and grades indicated on the approved Grading Plan. Excavate sufficiently over-size to permit installation and removal of concrete forms and other required work. Should soil of inadequate density and bearing capability be encountered at the elevations indicated on the drawings, or where new fill is to be placed upon existing loose fill material exposed by excavation, the excavation shall be carried to the depth required to attain soil of bearing quality as determined by the Geotechnical Engineer.

E. A California Licensed Surveyor (LS) must provide grade stakes and elevations for the Geotechnical Engineer to verify that the over-excavation depths, shown on the construction drawings for asphalt concrete pavement and concrete pavement structural sections, have been achieved prior to re-compaction.

F. Should footing excavations exceed required dimensions or should sloughing occur, fill such extra space with concrete at no additional cost to the contract. If unsuitable material is found at the indicated depths, immediately notify the Inspector.

G. Notify the Inspector 48 hours before foundation excavations are ready for inspection.

H. The bottoms of footings shall be free of loose material, debris, and water before concrete is placed.

I. Cut banks shall be neatly trimmed to the required finish surface as the cut progresses, or the Contractor shall have the option of leaving the cuts full and finish grading by mechanical equipment which shall produce the finish surfaces as shown on the Drawings.

J. Surplus earth not needed for filling and grading shall be disposed of in a legal manner off the site.

K. All applicable requirements of the California Construction and General Industry Safety Orders, the Occupational Safety and Health Act of 1970, and the Construction Safety Act should also be followed.

L. Bills of lading or equivalent documentation will be submitted to the IOR on a daily basis.

M. Upon completion of import operations, provide the OAR a certification statement attesting that all imported material has been obtained from the identified source site.

3.05 HAZARDOUS MATERIALS

A. See Section 01 31 32: Import Materials Testing.

B. All import fill material shall be characterized, handled, and documented in accordance with applicable US EPA and State of California hazardous waste and hazardous materials regulations.

C. “Contaminated” shall mean any soil or geotechnical material at a concentration, which would require disposal at a regulated facility (i.e., California hazardous or RCRA hazardous).

D. Owner’s Authorized Representative (OAR) must be notified at least 72 hours prior to the disposal of any hazardous waste or hazardous material. No material disposal or reuse can take place without prior written approval of the OAR.

E. Replacement of earth material, that has been removed due to hazardous waste reasons, shall be placed back to meet the requirements of Section 2.01, G – Engineered Fill.

3.06 EXCAVATION FOR BUILDING

A. Refer to section 4.1.2 of the soils report for requirements.

B. The maximum allowable slope of excavation shall not be steeper than 1H:1V. When surcharge loads from stored material or equipment, operating equipment, or traffic are present, a competent person shall determine the degree to which the actual slope must be reduced below the maximum allowable slope, and shall assure that such reduction is achieved. If the excavation is within 10 ft from surcharge loads from adjacent structures, contractor should notify the geotechnical engineer of record to evaluate the situation and provide appropriate recommendation. A competent person should daily observe the sloped excavation for any distress and notify the geotechnical engineer of record when distress is observed. Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.

3.07 EXCAVATION FOR FREE STANDING MASONRY SITE WALLS AND CONCRETE BENCHES & LOW WALLS

A. The soil underneath brick masonry site wall footings shall be overexcavated and recompacted to a minimum depth of 12 inches below the bottom of the proposed footings or to a sufficient depth to remove all of the undocumented fill materials in their entirety from within the proposed site masonry wall footing area.

3.08 EXCAVATION, BACKFILL & COMPACTION FOR UTILITIES

A. Field conditions may require deviations from information indicated on Drawings. Such changes in work shall be covered by a Change Order, indicating an increase or decrease in the Contract sum.

B. Before excavation, Contractor shall contact the "Underground Service Alert of Southern California" (USASC) for information on buried utilities and pipelines.

C. When connections are to be made to any existing pipe, conduit, or other appurtenances, the actual elevation or position of which cannot be determined without excavation, the Contractor shall excavate for, and expose, the existing improvement before laying any pipe or conduit. The Engineer shall be given the opportunity to inspect the existing pipe or conduit before connection is made. Any adjustments in line or grade which may be necessary to accomplish the intent of the plans will be made, and the Contractor will be paid for any additional work resulting from such change in line or grade.

D. Trenches, ditches, pits, sumps, and similar items which are outside the barricaded working area shall be barricaded to conform to Cal OSHA standards.

E. Trenches over 5'-0" in depth shall conform to the Construction Safety Orders of the California Division of Industrial Safety, see Section 2.3 EXCAVATION SUPPORT & PROTECTION – SHORING PLAN.

F. Safe and suitable ladders which project 2 feet above the top of the trench shall be provided for all trenches over 4 feet in depth. One ladder shall be provided for each 50 feet of open trench, or fraction thereof, and be so located that workers in the trench need not move more than 25 feet to a ladder.

G. Where indicated and/or required to excavate in lawn areas, protect adjoining lawn areas outside of the Work area. Replace or install removed sod upon completion of backfill by installing sod level with adjacent lawns. If installation of removed sod fails, furnish sod and install to match existing lawns.

H. All trenches should be backfilled with approved fill material compacted to relative compaction of not less than 90 percent of maximum density determined in accordance with ASTM D 1557. Backfill shall be placed in layers not exceeding 8" (inches) in thickness.

I. Backfill over excavations to the required elevations with earth, gravel, sand, or concrete and compact as required. Provide excavations free from standing water by pumping, draining, or providing protection against water intrusion. Slope adjacent grades away from excavations to minimize entry of water.

J. Do not excavate trenches parallel to footings closer than 18" from the face of the footing or below a plane having a downward slope of 2 horizontal to one vertical, from a line 9" above bottom of footings.

K. If soft, spongy, unstable, or other unsuitable material is encountered upon which the bedding material or pipe is to be placed, this material shall be removed to a depth ordered by the Engineer and replaced with bedding material suitably densified. Additional bedding so ordered, over the amount required by the Plans or Specifications, will be paid for as provided in the Bid. If the necessity for such additional bedding material has been caused by an act of failure on the part of the Contractor or is required for control of groundwater, the Contractor shall bear the expense of the additional excavation and bedding.

L. Unless indicated otherwise on the plans are within this specification, excavate trenches to the required depths for utilities, such as pipes, conduit and tanks, with minimum allowances of 6 inches at the bottom and 6 inches at the sides for bedding of unprotected piping or as required for concrete encasement of conduits as indicated on Drawings. Maximum allowances at the sides for trenching shall be 12 inches. Grade bottom of trenches to a uniform smooth surface. Remove loose soil from the excavation before installing sand bedding or concrete encasement.

M. Where portions of existing structures, walks, paving, etc. must be removed or cut for pipe or conduit installation, replace the material with equal quality, finished to match adjacent work.

N. Provide a minimum clear dimension of 6 inches from sides of wall excavation to outer surfaces of buried pipes or conduits installed in the same trench or outside surfaces of containers and/or tanks.

O. **DO NOT** place backfill until the bedding and pipe work installed has been inspected, tested and approved by the Inspector. Remove excavated rocky material unsuitable for backfill from the site prior to final backfilling.

P. Bedding material immediately around a utility line and to a point 12 inches above the line should consist of sand, fine-grained gravel, or cement slurry to support the line and protect it.

Q. Bedding zone shall be defined as the area containing the material specified that is supporting, surrounding, and extending to 12" (inches) above the top of pipe.

R. Bedding material shall first be placed on a firm and unyielding subgrade so that the pipe is supported for the full length of the barrel. There shall be 6" (inch) minimum of bedding below the pipe barrel and 1" (inch) clearance below a projecting bell for sewer, storm drain and water pipe. The material in the bedding zone shall be placed and densified by mechanical compaction only.

S. Mechanically compacted backfill shall comply with section 306-1.3.2 of the Standard Specifications for Public Works Construction.

T. Concrete backfill trenches that carry below or pass under footings and that are excavated within 18 inches of footings. Place concrete to level of bottom of footings.

U. Fill voids with approved backfill materials as shoring bracing and sheeting is removed.

3.09 INSPECTION & TESTING AT TRENCHES

A. Pipe will be inspected in the field before and after laying. If any cause for rejection is discovered in a pipe after it has been laid, it shall be subject to rejection. Any corrective work shall be approved by the Engineer and shall be at NO cost to the Owner.

B. The Inspector or Geotechnical Engineer will inspect all subgrades and excavations prior to placing bedding & backfill materials.

C. **DO NOT** place backfill until the bedding and pipe work installed has been inspected, tested and approved by the Inspector. Remove excavated rocky material unsuitable for backfill from the site prior to final backfilling.

D. Utility backfill compaction test shall be performed in accordance with ASTM D1557, method "C".

E. Utility backfill in place density test per ASTM D 1556 (sand cone) or other test method as considered appropriate by the Geotechnical Engineer.

F. Hydrostatic pressure tests shall be done only after backfill has been placed and final compaction has been achieved.

3.10 APPROVAL OF SUBGRADE

A. Notify Geotechnical Engineer when excavations have reached required over-excavation subgrade.

B. When Geotechnical Engineer determines that unforeseen unsatisfactory soil is present, continue work only after receiving direction from the Contracting Officer.

C. Reconstruct subgrades damaged by rain, accumulated water or construction activities as directed by the Soils Engineer.

3.11 UNAUTHORIZED EXCAVATION

A. Fill of unauthorized excavation below bottoms of foundations or wall footings will be engineered fill.

B. Fill unauthorized excavations under other construction as directed by the Soils Engineer.

C. Where indicated widths of utility trenches are exceeded, provide stronger pipe, or special installation procedures, as required by the Geotechnical Engineer.

3.12 STORAGE OF SOIL MATERIALS

A. After the site has been stripped of all debris, vegetation and organic materials, excavated on site soils may be reused as engineered fill provided they meet the satisfactory soils material conditions in Section 2.01, part D. High in-site moisture contents will require aeration prior to placement as engineered fill.

B. Stockpile excavated materials acceptable for backfill and fill soil materials, including acceptable borrow materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees. Cover to prevent wind-blown dust.

3.13 PLACEMENT OF ENGINEERED FILL

A. Preparation of the bottom of the excavation:

1. Where structural foundations, slab on grade construction, asphalt pavement and concrete flatwork engineered fill is to be placed, the upper 6" (inches) of native soil must be scarified, moisture conditioned, and re-compacted to a minimum of 90 percent of the maximum dry unit weight as determined by the ASTM Test Method D1557.

B. Spreading and Compacting Fill Material:

1. All fills shall be placed in lifts no greater than 6 inches thick (loose measurements), and should be re-compacted to a minimum of 90 percent of the maximum dry unit weight as determined by the ASTM Test Method D1557.

2. After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted by the Contractor to the specified density. Compaction shall be accomplished by sheepsfoot rollers; vibratory rollers; multiple-wheel, pneumatic-tired rollers; or other types of acceptable compacting equipment. Equipment shall be of such design that it will be able to compact the fill to the specified density. Compaction shall be continuous over the entire area, and the equipment shall make sufficient passes to obtain the desired density uniformly. Jetting, puddling and hydroconcolitation techniques shall not be used.

3. When backfilling and compacting behind retaining walls and flexible retaining structures, the Contractor shall use lightweight compaction equipment such as hand-operated equipment, shoring, or other means to avoid over-stressing structural walls. When using lightweight compaction equipment, the fill materials shall be spread in horizontal layers not greater than 6 inches thick, measured before compaction.

C. Compaction Testing:

1. The Geotechnical Engineer's representative shall observe the excavation, filling, and compacting operations and shall make density tests in the fill material so that he can state his opinion as to whether or not the fill was constructed in accordance with the specifications. If the surface is disturbed, the density tests shall be made in the compacted materials below the disturbed zone. When these tests indicate that the density or moisture content of any layer of fill or portion thereof does not meet the specified density or moisture content, the particular layer or portions shall be reworked until the specified density and moisture content have been obtained.

2. Sampling and testing of materials for determination of compliance with the specified compaction requirements will be conducted by the Geotechnical Engineer's representative at any location and time as the Owner may determine.

3. The Contractor shall be responsible for excavation of the test pits and for providing and installing any shoring, ladders, or other equipment necessary to protect the testing personnel. The Contractor shall also suspend operations as necessary and at no cost to the owner for the purpose of conducting such testing.

4. Test pits shall be excavated in the backfill by the Contractor as directed by the Engineer for the purpose of testing the backfill compaction. At the option of Engineer, density tests may be taken on a lift of compacted backfill immediately before placing the next lift.

5. Any settlement noted in backfill, fill, or in structures built over the backfill or fill within the one-year warranty period will be considered to be caused by improper compaction methods and shall be corrected at the Contractor's expense. Structures damaged by settlement shall be restored to their original condition by the Contractor at the Contractor's expense.

6. When initial compaction testing performed by the Engineer indicates the required density has not been obtained, the Contractor shall re-compact or replace the backfill as necessary to meet the specified minimum density.

7. The Contractor shall be responsible for rescheduling compaction testing with the Engineer and shall bear all costs for subsequent retesting in the areas of noncompliance. Costs associated with retesting and scheduling delays shall be the sole responsibility of the Contractor. The Engineer will deduct the costs for testing of materials and work found to be unacceptable, as determined by the tests performed by the Owner and the costs for testing of material sources identified by the Contractor which are not used for the work, from moneys due or to become due to the Contractor. The amount deducted will be determined by the Engineer.

3.14 BACKFILL - GENERAL

A. Backfill excavations promptly, but not before completing the following:

1. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.

2. Surveying locations of underground utilities for record documents.

3. Testing, inspecting, and approval of underground utilities.

4. Concrete formwork removal.

5. Removal of trash and debris from excavation.

6. Removal of temporary shoring and bracing, and sheeting.

7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

3.15 GRADING

A. Rough & Fine Grading: Rough grade area sufficiently high to require cutting by fine grading.

B. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between existing adjacent grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to conform to required surface tolerances.
3. Grade area for paving to a depth below finish grades indicated, equal to base and pavement thickness to be constructed.
4. Cut banks neatly to required finish grades as cut progresses, or leave cuts full and finish grading by mechanical equipment, which will produce finish grades indicated on Drawings.
5. Grade filled banks full and compact beyond grade of finish bank so that when trimmed to finish grades, soil is compacted to density specified for final slope face.
6. Bring areas to be graded to approximate finish grades and then scarify, moisten and roll to obtain required density. Scarify, moisten and roll resulting high and low areas to obtain required finish grades by cutting and filling.
7. Grade future planting areas so that, upon cultivation and fertilization, they will conform to finish grades indicated for planting areas.
8. Protect all utilities.

C. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Building pad tolerance plus or minus ½ inch (0.05-foot).
2. Lawn or Unpaved Areas: Plus or minus (0.10-foot).
3. Walks: Plus or minus (0.04-foot).
4. Pavements: Plus or minus (0.04-foot).

D. Grading Inside Building Lines: Finish subgrade to a tolerance of ½ inch when tested with a 10-foot straightedge.

3.16 FIELD QUALITY CONTROL

A. The CONTRACTOR shall provide an independent approved California Department of Health Services certified testing laboratory, to perform sampling and testing of import/export fill materials in accordance with the terms as specified in Section 01 31 32: Import Materials Testing.

B. A Geotechnical Engineer, designated by the Owner, will be engaged to perform continuous inspection of the placing and compacting of all fills and backfills within the limits of grading of this project. All work shall be done in accordance with the approved plans and these specifications and as recommended and approved by the Geotechnical Engineer. Revised recommendations relating to conditions differing from the approved soils engineering and engineering geology reports shall be submitted to the owner, inspector, architect and the civil engineer. Costs for all such inspections and tests shall be paid by the Owner. The Contractor shall be responsible for notifying the Geotechnical Engineer in advance so that he may be present to perform his services as needed.

C. The Geotechnical Engineer shall submit compaction reports to the Construction Manager and the Architect at the completion of the work, including test results and plot plans indicating the locations from which the tested samples of fill were taken. The Geotechnical Engineer shall keep the Construction Manager informed on the progress of the grading work.

D. Testing Agency Services: Allow testing agency to inspect and test each subgrade and each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.

1. Perform field in-place density tests according to ASTM D 1556 (sand cone method) or other test method as considered appropriate by Geotechnical Engineer.

a. Field in place density tests may also be performed by the nuclear method according to ASTM D 2922, provided that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. With each density calibration check, check the calibration curves furnished with the moisture gages according to ASTM D 3017.

b. When field in place density tests are performed using nuclear methods, make calibration checks of both density and moisture gages at beginning of work, on each different type of material encountered, and at intervals as directed by the Architect.

2. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, perform at least one field in-place density test for every 2,000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.

3. Foundation Wall Backfill: In each compacted backfill layer, perform at least one field in place density test for each 100 feet or less of wall length, but no fewer than two tests along a wall face.

4. Trench Backfill: In each compacted initial and final backfill layer, perform at least one field in place density test for each 150 feet or less of trench, but no fewer than two tests.

E. When testing agency reports that subgrades, fills, or backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, recompact and retest until required density is obtained.

F. Owner’s inspector will inspect foundation excavations when completed and ready for forms, after forms are in place, and before first placement of concrete.

3.17 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and re establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace material to depth directed by the Architect; reshape and recompact at optimum moisture content to the required density.

C. Settling: Where settling occurs during the Project correction period, remove finished surfacing, backfill with additional approved material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off the Owner's property.

END OF SECTION 312000

SECTION 32 01 30 – LANDSCAPE MAINTENANCE

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Work Specified in this Section: Furnish all labor, material, equipment, and services required to maintain the landscape in an attractive condition as specified herein for a period of 90 calendar days.

B. Related Work Specified in Other Sections:
   1. Section 32 84 00: Landscape Irrigation
   2. Section 32 90 00: Landscape Planting

C. Definition: The word Architect as used herein shall refer to the Landscape Architect or the Owner's authorized representative.

1.2 QUALITY ASSURANCE

A. The Contractor's representatives and employees shall be experienced in landscape maintenance.

1.3 90 CALENDAR DAY MAINTENANCE PERIOD

A. The Contractor shall continuously maintain all areas involved in this Contract during the progress of work. Maintenance period shall not start until all elements of construction, planting, and irrigation for the entire project are in accordance with Plans and specifications.
   1. A prime requirement is that all lawn and groundcover areas shall have been planted and that all lawn areas shall show an even, healthy stand of grass seedlings or sod, either of which shall have been mowed twice. Maintenance period will not be shortened when this criteria is met, but may be lengthened if not met.
   2. The Contractor’s maintenance period will be extended if the provisions required within the Plans and specifications are not fulfilled. Project may not be segmented into maintenance phases.
   3. The Contractor shall request a Pre-Maintenance inspection by the Owner and Architect at the completion of the installation process.
   4. The Maintenance Period shall begin upon successful completion of the Pre-Maintenance walk-through punch list and acceptance of the landscape installation by the Owner.
   5. If such criteria are met to the satisfaction of the Owner, a field notification will be issued to the Contractor to establish the effective beginning date of the maintenance period.

B. The Maintenance Period continues for 90 calendar days until final acceptance of the work by the Owner. Improper maintenance or poor condition of planting at the termination of the scheduled maintenance period may cause postponement of the final completion date of the Contract.

C. Any day when the Contractor fails to adequately maintain planting, replace unsuitable plants or do weed control or other work, as determined necessary by the Owner, will not be credited as one of the maintenance period working days.

1.4 GUARANTEE AND REPLACEMENT

A. Guarantee: All plant material installed under the contract shall be guaranteed for a period of one year from the Start of the Maintenance Period. Plants found to be dead or in poor condition due to faulty materials or workmanship, as determined solely by the Architect, shall be replaced by the Contractor at his expense.
   1. Replacement: Materials found to be dead, missing, or in poor condition during the Maintenance period shall be replaced immediately.
   2. The Architect shall be the sole judge as to the condition of material.
   3. The Contractor shall replace material rejected during the Guarantee period within fifteen (15) days of written notification by the Owner.

1.5 OBSERVATION VISITS

A. The Contractor shall request progress visits from the Architect at least 72 hours in advance of anticipated visits. Normal observation visits are as follows:
   1. Immediately prior to the commencement of the work in this section.
   2. Completion of first 90 days of maintenance.
   3. Final acceptance.

1.6 FINAL ACCEPTANCE OF THE PROJECT

A. Prior to the date of the final observation visit, the Contractor shall acquire from the Architect-approved reproducible Plans and record (from the job record set) all changes made during construction, label these Plans "Record Drawings", and deliver to the Architect for review and approval.

B. Prior to the date of final inspection, the Contractor shall deliver to the Architect a written "Landscape and Irrigation Guarantee" as required herein.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All materials used shall either conform to landscape specifications in other sections or shall otherwise be acceptable to the Owner.

B. The Owner shall be given a monthly record of all herbicides, insecticides, and disease control chemicals used. Failure to provide such a record will continue maintenance period until compliance occurs.

PART 3 - EXECUTION

3.1 MAINTENANCE

A. Maintenance shall be performed according to the following standards:
   1. All areas shall be weeded and cultivated at intervals of not more than ten (10) days.
   2. Watering, mowing, rolling, edging, trimming, fertilization, spraying, and pest and rodent control, as may be required, shall be included in the maintenance period.
   3. Street gutters shall be cleaned as part of the maintenance program.
   4. The Contractor shall be responsible for maintaining adequate protection of the area.

a. Damaged areas shall be repaired at the Contractor's expense.

5. Between the 15th day and the 20th day of the maintenance period, the Contractor shall reseed and re-sod all spots or areas within the lawn where normal turf growth is not evident.

B. The Contractor shall be responsible for reporting to the Owner conditions beyond his control that prevent or have negative impact on the work required herein.

3.2 TREE AND SHRUB CARE

A. Watering
1. Apply enough irrigation water so that moisture penetrates throughout root zone and only as frequently as necessary to maintain healthy growth.
   a. Do not maintain soils in a constantly wet condition.
   b. Contractor shall be responsible for familiarizing himself with the particular water requirements for the various plantings and shall be responsible for setting and maintaining the automatic controller to optimum minimum levels.
   c. Damage to the plantings caused by over-watering or under-watering shall be the responsibility of the Contractor to replace at no cost to Owner.
2. Maintain a water basin around newly planted plants so that water can be applied to moisturize throughout the root zone. At the end of the maintenance period these basins shall be flattened out to match surrounding grades.
3. If hand-watering, use a fan spray nozzle to break the water force.

B. Tree Pruning
1. Nursery grown trees will not normally require pruning for the first year. Prune trees only if directed by Architect or Owner, and only for these purposes:
   a. selection and development of permanent scaffold branches that have a vertical spacing of from 18" to 48" and radial orientation so as not to cross each other,
   b. elimination of diseased or damaged growth,
   c. elimination of narrow V-shaped branch forks that lack strength,
   d. reduction of toppling and wind damage by thinning out crowns,
   e. maintenance of growth within space limitations,
   f. maintenance of natural appearance,
   g. Balancing of crown-to-root ratio.
2. Under no circumstances will stripping of lower branches ("rising up") of young trees be permitted.
   a. Lower branches shall be retained in a “tipped-back" or pinched condition with as much foliage as possible to promote caliper trunk growth (tapered trunk).
   b. Lower branches can be cut flush with trunk only after the tree is able to stand erect without staking or other support.
3. Evergreen trees shall be thinned out and shaped when necessary to prevent wind and storm damage. The primary pruning of deciduous trees shall be done during the dormant season. Damaged trees or those that constitute health or safety hazards shall be pruned at any time of the year as required.

C. Shrub Pruning
1. The objectives of shrub pruning are the same as for trees. Shrubs shall not be clipped into balled or boxed forms unless such is required by the design.
2. All pruning cuts shall be made to lateral branches or buds or flush with the trunk. "Stubbing" will not be permitted.

D. Staking and Guying: Stakes and guys shall remain in place until final acceptance and are to be continuously inspected and adjusted to prevent girdling of trunks or branches and to prevent rubbing that causes bark wounds and to allow trees to sway freely. Stakes and guys are to be removed when trees become sufficiently well rooted or after one year. When stakes or guys are removed, tree heads may be thinned to reduce wind load.

E. Weed Control: Keep all areas, including basins and areas between plants, free of weeds.
1. Use recommended legally approved herbicides only when mechanical removal methods are not feasible.
2. Avoid frequent soil cultivation next to trees or shrubs that destroys shallow roots.
3. Use mulches to help prevent weed seed germination.

F. Pest and Disease Control: Maintain control of insect and rodent infestations. The preferred method of control shall be biological control, or with non-toxic, biodegradable, organic materials. If stronger materials are needed, only materials that are recommended by a licensed Pest Control Advisor and are EPA approved and regulated shall be used. Only registered and licensed Pest Control Operators shall apply insecticide or chemical applications. Notify Owner a minimum of five (5) working days before chemical applications.

G. Fertilization
1. Fertilize all planting areas at 30-day intervals, with fertilizer and at rate as recommended by Soils Report.
    a. Avoid applying fertilizer to root balls and bases of main stems
    b. Spread fertilizer evenly around plants to drip line.
    c. Distribute fertilizer evenly over turf or groundcover areas to avoid patchy coloration.

H. Replacement of Plants: Replace dead, dying, and missing plants with plants of a size, condition, and variety acceptable to Architect or Owner at Contractor's expense.

3.3 GROUND COVER CARE

A. Weed Control: Control weeds preferably with mechanical methods, and also with preemergent herbicides and selective systemic herbicides. Hoe weeds as little as possible since this may result in plant damage. Foot traffic in planted areas shall be minimized, and soil compaction shall be loosened immediately.

B. Watering: Water enough so that moisture penetrates throughout root zone and only as frequently as necessary to maintain healthy growth.
1. Do not maintain soils in a constantly wet condition.
2. Contractor shall familiarize himself with the particular water requirements for the planting and shall be responsible for setting and maintaining the automatic controller to optimum minimum levels.
3. Damage to the planting caused by over-watering or under-watering shall be the responsibility of the Contractor to replace.

C. Trash: Remove trash weekly. Remove debris, clippings or branches produced by maintenance activities within 8 hours.

D. Edging and Trimming: Edge ground cover to keep in bounds and trim top growth as necessary to achieve an overall even appearance.

E. Replacement: Replace dead and missing plants at Contractor's expense.

3.4 LAWN AND TURF CARE

A. Mowing and Edging:
   1. Mowing of turf will commence when the grass has reached a recommended height for the specified species. Mowing will be at least twice a week after the first cut. Turf must be well-established and free of bare spots and weeds to the satisfaction of the Architect prior to final acceptance.
   2. Edges shall be trimmed at least weekly or as needed for neat appearance.
   3. Grass clippings if visible in piles regardless of size shall be removed from the premises.

B. Watering: Lawns shall be watered at such frequency as weather conditions require to replenish soil moisture below root zone and maintain healthy growth.

C. Fertilizing:
   1. Fertilize all on-grade lawn areas as follows or as recommended by soils report:
      a. At the end of the first 30 calendar days and at 30 to 90 calendar day intervals thereafter - 5 lbs. per 1,000 square feet of maintenance fertilizer.
      b. After application, irrigate thoroughly.

D. Weed Control: Remove broad leaf weeds manually or control with selective herbicides. Turf areas shall be kept weed-free.

E. Renovating:
   1. If required, remove thatch by verticutting, preferably in the fall but otherwise in the spring. At this time, fertilize with maintenance fertilizer and over-seed if needed.
   2. Certify compacted areas to improve water penetration whenever needed.

3.5 IRRIGATION SYSTEM

A. System Inspection: Contractor shall continuously check all systems for proper operation. Lateral lines shall be flushed out after removing the last sprinkler head or two at each of the lateral. All heads are to be continuously adjusted as necessary for proper coverage and to eliminate over-spray on buildings or paving. Contractors regular maintenance personnel shall test, observe, and adjust each sprinkler system no less than once per month.

B. Controllers: Set and program automatic controllers for seasonal water requirements and minimum optimum water use. Give Owner's representative a key to controllers and instructions on how to turn off system in case of emergency.

C. Repairs: Repair all damage to irrigation system at Contractor's expense. Repairs shall be made within one watering period.

END OF SECTION 32 01 30

This page intentionally left blank.

SECTION 32 12 16 - ASPHALT PAVING

PART 1 - GENERAL

1.1 REQUIREMENT

A. The Contractor shall furnish all tools, equipment, materials, and supplies and shall perform all labor required to complete the work as indicated in the Contract Documents and specified herein.

B. The following types of pavement shall be covered in this Section:
   1. Paving for utility trenching, parking lots, playgrounds, areas between buildings, adjacent to planting and turf areas, and as indicated on Construction Documents.

C. Related Sections:
   1. Section 31 20 00: Earthwork.
   2. Section 32 12 36: Seal Coat.
   3. Section 32 17 13: Pavement Markings.

1.2 QUALITY ASSURANCE

A. The work provided herein shall conform to and be in accordance with the Contract Plans, General Conditions/Specifications and Special Provisions, as well as the Standard Specifications for Public Works Construction (“GREENBOOK”), 2015 Edition, adopted by the Southern California Chapter, American Public Works Association; herein referred to as the “Standard Specifications”.

B. The Owner's inspector shall test the temperature of each batch of asphaltic concrete prior to placement. At the time of delivery to the work site, the temperature of mixture shall not be lower than 260 degrees F or higher than 320 degrees F, the lower limit to be approached in warm weather and the higher in cold weather. If asphaltic concrete temperature is not within these tolerances the affected batch shall be rejected. Any and all costs due to the rejected asphaltic concrete shall be the responsibility of the paving contractor.

1.3 ESTABLISHMENT OF GRADES

A. The Contractor’s Surveyor will set grade stakes. The Surveyor shall be a California registered land surveyor or licensed Civil Engineer. The Surveyor shall be hired and paid by the Contractor, and shall be subject to the approval of the Owner. Contractor shall notify the Owner at least 48 hours before staking is to be started. The Owner will determine if work is ready for staking.

B. All work shall conform to the lines, elevations, and grades shown on the Construction Plans. Three consecutive points set on the same slope shall be used together so that any variation from a straight grade can be detected. Any such variation shall be reported to the Engineer. In the absence of such report, the Contractor shall be responsible for any error in the grade of the finished work.

C. Protect and maintain stakes in place until their removal is approved by the Owner. Grade or location stakes lost or disturbed by Contractor, shall be reset by the Surveyor at the expense of Contractor.

D. Areas having drainage gradients of 2 percent or more shall have elevation stakes, set with instrument, at grid intervals of 25 feet. Intermediate stakes may be set by using a tightly-drawn string line over the tops of adjacent stakes. Grade stakes must be set at all grade breaks, grade changes, etc.

E. Areas having drainage gradients of less than 2 percent shall have elevation stakes, set with instrument, at 10 foot intervals. Grade stakes must be set at all grade breaks, grade changes, etc.

1.4 SUBMITTALS

A. Mix Designs: The CONTRACTOR shall formulate a job-mix formula using the Hveem method in accordance with Standard Specifications Section 203-6.2 and submit it to the ENGINEER for approval. The resultant mixture shall have Hveem properties conforming to Standard Specifications Section 203-6.4.3.

B. Samples:

1. Prior to the delivery of specified aggregate to the site, the CONTRACTOR shall submit samples of the material for the INSPECTOR's acceptance in accordance with Standard Specifications Section 4-1.4. Samples shall be typical of materials to be furnished from the proposed source and in conformance with the specified requirements.

2. Aggregate base gradation and quality certifications shall be dated within 30 days of the submittal.

C. Certificates

1. Twenty days prior to the delivery of aggregates, asphalt materials, and paving mixes to the project site, the Contractor shall submit to the Engineer certificates and test results of compliance of such materials with these specifications.
2. Submit certificates of compliance from the supplier for bituminous materials for paint binder, asphaltic concrete, and seal coat.
3. Submit weigh master's certificates or certified delivery tickets for each truck load of asphaltic material delivered to the project site.
4. Upon completion of the weed control treatment, and as a condition for final acceptance, furnish a written certificate stating the brand name of the sterilant and the manufacturer, and that the sterilant used had at least the minimum required concentration, and that the rate and method of application complied in every respect with the conditions and standards contained herein.

1.5 QUALITY CONTROL

A. Asphaltic Concrete Producers Qualifications: Use only materials furnished by a bulk asphaltic concrete producer regularly engaged in production of hot mix, hot laid bituminous concrete.

B. Applicator Qualifications: Paving machine and roller operators shall be fully trained and experienced in the installation of asphaltic concrete paving on projects of similar size and complexity.

C. Regulatory Requirements: The quantity of volatile organic compounds (V.O.C.) used in weed killer, seal coat, primer and other materials shall not exceed the limits permitted under the current regulations of the local authorities having jurisdiction.

1.6 ENVIRONMENTAL LIMITATIONS

A. Do not apply asphalt materials if substrate is wet or excessively damp or if the following conditions are not met:

1. Tack Coats: Minimum surface temperature of 60 deg F.
2. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
3. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

1.7 PAVEMENT-MARKING PAINT

A. Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Base Course Material: Crushed aggregate base material shall consist of materials that meet the provisions of Specifications Section 31 20 00 Earthwork, Part 2.01-F.

B. Asphalt Surfacing Materials: Furnish asphalt surfacing meeting the following requirement, furnished from a commercial asphalt central mixing plant.

1. Paint Binder/Tack Coat: Asphalt emulsion shall be CSS-1 or CSS-1h and shall conform to the requirements of Standard Specifications Section 203-3 Emulsified Asphalt.
2. Asphalt Concrete Composition & Grading:
   a. Surface course asphalt concrete in other areas shall conform to Standard Specification Section 203-6.4.3, Type C2, with asphalt content of 4.6% to 6.0%.
   b. Base course asphalt concrete, in all areas, shall conform to Standard Specification Section 203-6.4.3, Type B, with asphalt content of 4.5% to 5.8%.
   c. Asphalt performance grade shall be PG-64-10.
   d. At least two courses of asphalt shall be laid when Type C2 asphalt pavement is greater than 3 inches. The surface course shall be a minimum thickness of one inch (1”) and a maximum of two inches (2”).

C. Weed Control:

1. The soils sterilant shall be in accordance with current EPA acceptable standard and the California Department of Pesticide Regulations for soils sterilant. Sterilant shall be selected as appropriate for the environment in which is it to be placed. Contractor shall be licensed with the State of California to apply sterilant. Sterilant shall be commercial grade for commercial application. Payment for soil sterilization will include full compensation for application and all materials and incidental work required.
2. Apply Dow Elanco Spike 80DF, or approved equal, to subgrade of all areas to receive new asphalt pavement. Spike 80DF weed control should be applied at the rate of seven pounds per acre. If another manufacturer is used follow their recommendations.

D. Headers and Stakes:

1. Headers: Redwood, Construction Heart Grade, size 2 x 6, unless otherwise indicated on construction drawings
2. Stakes: 2 x 4 redwood or 2 x 3 Douglas fir, Construction Grade.
3. Nails: Common, galvanized, 12d minimum.

PART 3 - EXECUTION

3.1 HEADERS

A. Install headers along edge of bituminous surfacing abutting turf, earth, or planting area, unless indicated otherwise.

B. Install headers so the bottom surface has continuous bearing on solid grade. Where excavation for headers is undercut, thoroughly tamp soil under the header. Compact backfill on both sides of header to the density of adjacent undisturbed earth.

C. Fasten headers in place with redwood or Douglas fir stakes of length necessary to extend into solid grade a minimum of 12 inches. Stakes shall be of sound material, neatly pointed, driven vertically, and securely nailed to headers. Space stakes, not to exceed 4 feet on centers with top of stakes set one inch below top of header. Provide a minimum of 2-12d galvanized common nails through each stake.

D. Remove existing headers where new surfacing is installed adjacent to existing surfacing.

E. Install temporary headers at transverse joints of paving where continuous paving operations are not maintained.

F. Provide additional stakes and anchorage as required to fasten headers in place

3.2 SUBGRADE PREPARATION

A. Subgrade Preparation:
1. It is required that asphalt concrete pavement be underlain by crushed aggregate base (CAB) material, thickness as noted on the plans, which meets the provisions of S.S.P.W.C. Section 200-2.2. CAB shall be placed and compacted to a minimum of 95% of maximum density.

2. See project soils report section 4.1.3 for subgrade preparation requirements.

B. The above subgrade preparation recommendations are based on the assumption that soils encountered during field exploration are representative of soils throughout the site. However, there can be unforeseen and unanticipated variations in soils between points of subsurface exploration. For this reason, the actual subgrade preparation will have to be determined on the basis of in-grading observations and testing performed by representatives of the project geotechnical consultant.

C. A California Licensed Surveyor (LS) must provide grade stakes and elevations for the Geotechnical Engineer to verify that the over-excavation depths, shown on the construction drawings for asphalt concrete pavement structural sections, have been achieved prior to re-compaction.

D. Subgrade tolerances: Subgrade for pavement shall not vary more than 0.02’ from the specified grade and cross section established by the Engineer. Subgrade for subbase or base material shall not vary more than 0.04’ from the specified grade and cross section. Variations within the above specified tolerances shall be compensating so that the average grade and cross section specified are met.

E. Correct irregularities by dressing down or filling as may be required, to bring areas to true subgrade elevations.

F. Where filling is required, scarify the subgrade to bond the new material to the in place material; use additional material as required, subject to the approval of the Architect, and provided by the Contractor.

G. Remove excess material from the site to a legal disposal area.

3.3 APPLICATION GENERAL

A. Finish elevations, extent of asphalt paving and locations of type of asphalt and class of base shall be as indicated and specified herein and on the Construction Documents. Bring subgrade elevations sufficiently below the finish elevations of the paving so as to accommodate the thickness of paving and base.

3.4 STERILANT APPLICATION

A. Place herbicide below base course. Meet the applicable environmental control requirements. Apply as directed by the manufacturer's printed instructions just before application of the base course. Sterilant shall not be applied within two feet of planting areas.

3.5 APPLICATION OF BASE COURSE

A. Install base course material, encompassing spreading and compacting, in accordance with the S.S.P.W.C. Section 301-2, Untreated Base.

B. After preparing the subgrade as specified in 3.5.A, all traffic on the subgrade shall be avoided. Should it be necessary to haul over the prepared subgrade, the CONTRACTOR shall drag and roll the traveled way as frequently as may be necessary to remove ruts, cuts, and breaks in the surface. All cuts, ruts, and breaks in the surface of the subgrade that are not removed by the above operations shall be raked and hand tamped. All equipment used for transporting materials over the prepared subgrade shall be equipped with pneumatic tires.

C. Continued use of sections of prepared subgrade for hauling, so as to cut up or deform it from the true cross-section, will not be permitted. The CONTRACTOR shall protect the prepared subgrade from all traffic.

D. Maintain the surface in its finished condition until the succeeding layer is placed.

3.6 PLACING ASPHALT CONCRETE SURFACING:

A. Asphalt binder (tack coat) shall be applied to all existing pavement surfaces to be overlaid and/or joined per section 302-5.4 of the Standard Specifications. Asphalt binder (tack coat) shall be applied to existing surfaces to be surfaced and between layers of asphalt concrete, except when eliminated by the Engineer. A layer of asphalt binder (tack coat) shall be applied to all vertical-cut faces and between subsequent AC lifts.

B. Asphalt Concrete Pavement:

1. All work shall be in accordance with Section 302-5 of the Standard Specifications, except as noted herein. Asphalt concrete work shall include full-depth patching and variable thick asphalt concrete transition areas. The Contractor shall, on a daily basis, provide the Inspector with copies of certificates of weight for all materials delivered to the job site and/or incorporated in the work. At no time shall the coarse aggregate that has segregated from the mix be scattered across the paved mat.
2. Asphalt concrete shall not be placed on any surface, which contains ponded water or excessive moisture in the opinion of the Engineer. If paving operations are in progress and rain or fog forces a shut down, loaded trucks in transit shall return to the plant, and no compensation will be allowed therefore. The Contractor shall furnish and use canvas tarpaulins to cover all loads of asphalt from the time that the mixture is loaded until it is discharged from the delivery vehicle, unless otherwise directed in writing by the Engineer
3. The Inspector will examine the base before the paving has begun. The Contractor will correct any deficiencies before the paving is started.
4. Asphalt concrete of the class indicated in Section 2.B.2 shall be laid in courses conforming to S.S.P.W.C. Table 302-5.5(A) unless otherwise stated herein.
5. At least two courses shall be laid when Type C2 asphalt pavement is greater then 3 inches. The surface course shall be a minimum thickness of one inch (1") and a maximum of two inches (2").

6. Successive courses may be laid upon previously laid courses as soon as the previous course has cooled sufficiently to show no perceivable displacement under equipment or loaded material delivery trucks and a tack coat has been applied.
7. Wherever AC pavement does not terminate against a curb, gutter, or another pavement, the Contractor shall provide and install a redwood or pressure treated Douglas fir header at the line of termination.
8. Smoothness of asphalt shall conform to section 302-5.6.2 of the Standard Specifications
9. Density shall conform to the below requirements:
    a. In-place density of the Asphalt Concrete will be based on test results from a nuclear gauge and core samples taken in accordance with CTM 375, "Determining the in Place Density and Relative Compaction of Asphalt Concrete Pavement" except as modified below. The Inspector will determine when core sample testing shall be completed.
    b. Asphalt Concrete shall be compacted to not less than 95.0 percent for a single test and not less than an average in place density of 96.0 percent relative compaction of the Laboratory Test Maximum Density as determined by, Caltrans Testing Method (CTM) 375 except as modified by these specifications.
    c. The materials testing laboratory, paid for by the contractor, will obtain random samples of the hot mix asphalt material from behind the paving machine in accordance with Caltrans Testing Method (CTM) 125, "Methods for Sampling Highway Materials and Products in Roadway Structural Sections", to determine the Laboratory Test Maximum Density of the asphalt mixture in accordance with CTM 308.
    d. Asphalt Concrete compaction shall be accepted based upon passing tests taken from the nuclear gauge. In the event that the nuclear gauge testing presents failing results, then core samples will be the determination for the in place density and acceptance or rejection of the compaction.
    e. When core testing is to be performed to determine the relative compaction after nuclear gauge testing has not produced passing tests, the materials testing laboratory will obtain four 4" diameter core specimens (or four 6" diameter core specimens) for determination of relative density of the completed pavement. The four cores shall represent the sample frequency requirements specified in CTM 375.
10. Pavement at all longitudinal joints shall have a Field Density of 95%, as described in 302-5.6.2 of the Standard Specifications. When the test results of the field cores are less than 95% Relative Compaction, the Contractor shall remove a 1 foot wide section on each side of the longitudinal joint. The Contractor shall replace the removed pavement with an asphalt mix that meets the job specification at no additional cost to the Owner.

3.7 FLOOD TESTING

A. Flood Test: Before acceptance, all pavements shall be water tested to ensure proper drainage as directed by the Inspector. The Contractor shall provide water for this purpose. The flooding shall be done by water tank truck. Depressions where the water ponds to a depth of more than 1/8-inch shall be filled or the slope corrected to provide proper drainage. The edges of the fill shall be feathered and smoothed so that the joint between the fill and the original surface is invisible. No standing water shall remain after 30 minutes on a 70 degree F (or warmer) day. Full compensation for complying with this requirement shall be considered as included in the Contract Unit Price for Asphalt Paving.

3.8 SEAL COAT

A. Allow new asphalt pavement to cure 30 days before application of seal coat. See Project Specification Section 321236: Seal Coat.

3.9 FIELD QUALITY CONTROL

A. Thickness: Tolerances for asphalt pavement thickness shall be ¼ inch, plus or minus

B. All paving shall drain properly before being accepted. Upon completion, the pavement shall be true to grade and cross section. The asphalt substrate, shall not vary from the planned cross slope by more than +- 0.1. When a 10 foot straightedge is laid on the finished surface of the asphalt, the surface shall not vary from the edge of the straightedge more than 1/8 inch, except at grade breaks. Where paving does not meet these tolerances, the paving material shall be repaired by a method determined by the Owner. Repairs shall not be made to pavement surface by feather-edging at the join lines. All expenses for pavement repair up shall be borne by the Contractor at NO cost to the Owner.

C. Corrective Measures: It is the Contractor's responsibility to determine if the planarity, cross slopes, and general specifications have been met. If all of the conditions have been met the Contractor must notify the Owner in writing of the acceptance of the asphalt paving.

3.10 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.11 CLEAN UP

A. Clean all debris and unused materials from the paving operation. Clean all surfaces that have been spattered or defaced as a result of the paving operation. Asphalt or asphalt stains which are noticeable upon surfaces of concrete, or materials which will be exposed to view, shall be promptly and completely removed. Cleaning shall be done in a manner that will not result in any discharge of contaminated materials into any catch basin. All expenses for clean up shall be borne by the Contractor at NO cost to the Owner.

END OF SECTION 321216

This page intentionally left blank.

SECTION 321236 - SEAL COAT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Surface sealer over new asphalt paved surfaces.

1.02 REFERENCES

A. The work provided herein shall conform to and be in accordance with the Contract Plans, General Conditions/Specifications and Special Provisions, as well as the Standard Specifications for Public Works Construction ("Green Book"), 2015 Edition, adopted by the Southern California Chapter, American Public Works Association; herein referred to as the "Standard Specifications".

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's product information and application procedures for bituminous surfacing.

1.04 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement: Standard Specifications Section 203-9, "SEALCOAT – ASPHALT BASED".

B. Obtain materials from same source throughout.

C. Schedule a pre-construction conference at jobsite in advance of beginning of Work. In existing areas to be seal coated and restriped, document existing striping to be duplicated before commencing seal coating work.

D. Review and resolve conflicts involving requirements of specifications. Record discussions and furnish copies to all attendees.

E. Beginning of Work means Contractor accepts all conditions.

F. Agitate bulk materials during transport.

1.05 REGULATORY REQUIREMENTS

A. Comply with local air quality management district regulations for emissions maximums.

B. Maintain control of vehicular and pedestrian traffic during seal coating operations as required for other construction activities and in accordance with local traffic authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Seal Coat: The materials for sealcoat shall conform to Section 203-9 – "Sealcoat – Asphalt Based" of the Standard Specifications. Before incorporation in the Work, the Contractor shall submit a 2 Liter (2-quart) sample of undiluted seal coat at no cost to the Owner.

1. Seal Coat: Provide one of the following surface seals:

Product Name	Manufacturer
GuardTop	Vulcan Materials Company
Over Kote	Diversified Asphalt Product
Park Top	Western Colloid Products
Sure Seal	Asphalt Coating Engineering
MasterSeal	SealMaster Pavement Products & Equipment

PART 3 - EXECUTION

3.01 REPAIRING AND SEALCOATING OF EXISTING SURFACES

A. Preparation of Surfaces:

1. Before placing the sealcoat, the pavement surface shall be cleaned by sweeping, flushing or other means necessary to removal all loose particles of paving, all dirt, and all other extraneous material. This shall include vegetation in pavement cracks and between pavement and curb/gutter. Prior to removal an approved herbicide, which leaves behind a visible blue marker dye, shall be sprayed where vegetation exists. Surface contaminates, grease or oil spots shall be cleaned to allow for proper adhesion.

2. Prior to applying sealcoat material, cracks wider then 1/8 inch shall be cleaned, treated with weed killer, and filled with an asphalt-based crack filler (large cracks may require several applications). For best quality, it is recommended that all broken asphalt be removed and patched with new asphalt. It is also suggested that extreme low spots be filled with new asphalt. **New asphalt must cure 30 days before application of sealcoat**.

3. Immediately before commencing the sealcoat operations, all surface metal utility covers (including survey monuments) shall be protected by thoroughly covering the surface with an appropriate adhesive and oiled or plastic paper. No adhesive material shall be permitted to cover, seal or fill the joint between the frame and cover of the structure. A vertical tab shall be placed on each cover for locating after the seal application is complete. The tab shall extend at least 3" above the existing pavement surface. Covers are to be uncovered and cleaned of asphalt emulsion material by the end of the same work day. Inspector shall inspect surfaces before the installation of seal coat.

4. For best results, the asphalt, just prior to being sealed, should be sprayed with a mist of water in an amount that will leave the surface damp but with no puddles or visible water. This procedure is critical when ambient temperature is hot with bright sunlight or when the pavement is excessively aged or porous.

5. Install barricades as required to divert traffic from operations. Install temporary "no parking" signs and similar notices.

B. Application:

1. Sealcoat may be mixed with water to obtain desired consistency for job requirements to a maximum of 20% of the total volume. Care should be taken not to over dilute. Material after dilution shall be mixed with a mechanical agitator to maintain consistency and ease of application. Note that as the pavement increases in roughness, the amount of dilution should be decreased.

2. Sealcoat shall only be applied when the atmospheric temperature is greater than 55 degrees F and if rain is not forecast for the period of 24 hours after application.

3. The sealcoat material shall be applied in two applications. Unless otherwise specified, the total quantity applied (before dilution) shall be 50 gallons per 1,000 square feet.

4. Sealcoat material shall be applied using a truck-mounted tank or wheeled container in continuous parallel lines and spread by means of brooms or rubber-faced squeegees either by hand or machine and in such a manner as to eliminate all ridges, lap marks, and air pockets.

5. Hand tools shall be available in order to remove spillage. Ridges or bumps in the finished surface will not be permitted. Sealcoat material shall be homogeneous prior to spreading, with no visible separation of solids and liquids.

6. When the first coat has completely dried to the touch, apply the second coat. While misting is not normally required before second coat, surface should be clean with no foreign materials on it.

C. Drying Time:

1. Sealcoat should be allowed to dry 24 – 48 hours before permitting traffic. When asphalt is cold or in shade, or air temperature is below 75 degrees F, based on general weather, humidity and temperature conditions, drying time may need to be extended.

3.02 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

B. Striping for parking or traffic flow should be done only after the sealcoat has thoroughly dried. It is recommended that a high quality water based Traffic Line Paint be used for best results.

3.03 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION 321236

This page intentionally left blank.

SECTION 321313 - CEMENT CONCRETE PAVEMENT

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The CONTRACTOR shall furnish all materials for concrete in accordance with the provisions of this Section and shall form, mix, place, cure, repair, finish, and do all other work as required to produce finished concrete, in accordance with the requirements of the Contract Documents.

B. The following types of concrete shall be covered in this Section:

1. Portland cement concrete pavement, cement walks, flatwork, curbs, gutters, retaining curbs, swales, trash pick-up areas, ramps, mowing strips, fence post footings, sliding gate concrete, catch basins, pipe bedding and encasements, transition structures, flagpoles and light standard bases and footings, splash blocks and equipment pads.

2. Portland cement concrete paving shall be stable, firm and slip resistant and shall comply with CBC sections 11B-302 and 11B-403.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Comply with the reference specifications of the GENERAL REQUIREMENTS.

B. The work provided herein shall conform to and be in accordance with the Contract Plans, General Conditions/Specifications and Special Provisions, as well as the Standard Specifications for Public Works Construction (“GREENBOOK”), 2015 Edition, adopted by the Southern California Chapter, American Public Works Association; herein referred to as the “Standard Specifications”.

C. Comply with the current provisions of the following Codes and Standards.

1. Federal Specifications:

a. UU-B-790A (Int.Amd. 1) Building Paper, Vegetable Fiber (Kraft, Waterproofed, Water Repellant and Fire Resistant).

2. Commercial Standards:

a. ACI 214 Recommended Practice for Evaluation of Strength Test Results of Concrete.

b. ACI 301 Specifications for Structural Concrete for Buildings.

c. ACI 315 Details and Detailing of Concrete Reinforcement.

d. ACI 318 Building Code Requirements for Reinforced Concrete.

e. ACI 347 Recommended Practice for Concrete Formwork.

f. ACI 350 Recommended Practice for Sanitary Structure.

g. ASTM C 31 Practices for Making and Curing Concrete Test Specimens in the Field.

h. ASTM C 33 Specification for Concrete Aggregates.

i. ASTM C 39 Test Method for Compressive Strength of Cylindrical Concrete Specimens.

j. ASTM C 40 Test Method for Organic Impurities in Fine Aggregates for Concrete.

k. ASTM C 42 Methods of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

l. ASTM C 78 Specification for Flexural Strength.

m. ASTM C 88 Test Method for Soundness of Aggregates by use of Sodium Sulfate or Magnesium Sulfate.

n. ASTM C 94 Specification for Ready-Mixed Concrete.

o. ASTM C 114 Method for Chemical Analysis of Hydraulic Cement.

p. ASTM C 131 Test Method for Resistance to Degradation of Small-Sized Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

q. ASTM C 136 Method for Sieve Analysis of Fine and Coarse Aggregate.

r. ASTM C 143 Test Method for Slump of Portland Cement Concrete.

s. ASTM C 150 Specification for Portland Cement.

t. ASTM C 156 Test Method for Water Retention by Concrete Curing Materials.

u. ASTM C 157 Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete.

v. ASTM C 172 Specification for Sampling Fresh Concrete.

w. ASTM C 192 Method of Making and Curing Concrete Test Specimens in the Laboratory.

x. ASTM C 260 Specification for Air-Entraining Admixtures for Concrete.

y. ASTM C 289 Test Method for Potential Reactivity of Aggregates (Chemical Method).

z. ASTM C 311 Method for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete.

aa. ASTM C 494 Specification for Chemical Admixtures for Concrete.

bb. ASTM C 618 Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

cc. ASTM C 979 Specification for Pigments for Integrally Colored Concrete

dd. ASTM D 1751 Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).

ee. ASTM E 119 Method for Fire Tests of Building Construction and Materials.

1.03 CONTRACTOR SUBMITTALS

A. Submittals shall be made in accordance with GENERAL REQUIREMENTS.

B. The following submittals and specific information shall be provided.

1. Mix Designs: Prior to beginning the WORK, the CONTRACTOR shall submit to the ENGINEER, for review, and approval, preliminary concrete mix designs for each class and type of concrete specified herein. The mix designs shall be designed by an independent testing laboratory acceptable to the ENGINEER. All costs related to such mix design shall be borne by the CONTRACTOR.

a. Each concrete mix submittal shall contain the following information:

1) Slump on which the design is based.

2) Total gallons of water per cubic yard.

3) Brand, type, composition and quantity of cement.

4) Brand type, composition and quantity of fly ash.

5) Specific Gravity and gradation of each aggregate.

6) Ratio of fine to total aggregate per cubic yard.

7) Weight (surface dry) of each aggregate per cubic yard.

8) Brand, type, and ASTM designation, active chemical ingredients and quantity of each admixture.

9) Copy of the Building and Safety Research Report Approval for each concrete admixture.

10) Air content.

11) Compressive strength based on 7 day and 28 day compression tests, including standard deviation calculations, corroborative data (if applicable), and required average comprehensive strength per ACI 318, Section 5.

12) Time of initial set.

13) Certification stamp and signature by a Civil or Structural engineer registered in state of California.

14) Certificate of Compliance for Cement.

2. Certified Delivery Tickets: Where ready-mix concrete is used, the CONTRACTOR shall provide certified weighmaster delivery tickets at the time of delivery of each load of concrete. Each certificate shall show the public weighmaster's signature, and the total quantities, by weight of cement, sand, each class of aggregate, admixtures, and the amounts of water in the aggregate and added at the batching plant as well as the amount of water allowed to be added at the site for the specific design mix. Each certificate shall, in addition, state the mix

number, total yield in cubic yards, and the time of day, to the nearest minute, corresponding to when the batch was dispatched, when it left the plant, when it arrived at the job, the time that unloading began, and the time that unloading was finished.

3. When a water reducing admixture is to be used, the CONTRACTOR shall furnish mix designs for concrete both with and without the admixture.

4. The CONTRACTOR shall furnish a Certificate of Compliance signed by the supplier identifying the type of fly ash and stating that the fly ash complies with ASTM C 618 and these Specifications, together with all supporting test data prior to the use of the fly ash the sample represents. The supporting data shall also contain test results confirming that the fly ash in combination with the cement and water to be used meets all strength requirements and is compatible with air-entraining agents and other admixtures.

5. The CONTRACTOR shall submit to the ENGINEER for review the design mix for fly ash concrete together with the design mix for portland cement (non-fly ash) concrete as specified in this Section.

1.04 QUALITY ASSURANCE

A. Testing for Portland Cement Concrete shall be sampled and tested in accordance with the ASTM and California Tests listed in the Standard Specifications for Public Works Construction, 2015 Edition, Section 201-1.1.5.

B. Samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, or not less than once for each 50 cubic yards of concrete, or not less than once for each 2,000 square feet of surface area for slabs. Additional samples for seven-day compressive strength tests shall be taken for each class of concrete at the beginning of the concrete work or whenever the mix or aggregate is changed.

C. The cost of all laboratory tests on cement, aggregates, and concrete, will be borne by the CONTRACTOR.

D. Concrete for testing shall be supplied by the CONTRACTOR at no cost to the Owner, and the CONTRACTOR shall provide assistance and facilities to the INSPECTOR in obtaining samples, and disposal and cleanup of excess material.

E. Curbs and gutters shall be staked by a Land Surveyor licensed to practice in the State of California.

F. Job Mock-Up

1. General

a. Make samples on-site; revise as required; obtain Architect's approval, 10 days prior to casting finished work.

b. Finished work to match approved samples.

c. Approved sample may be incorporated into the work. Retain samples until completion of all concrete work.

d. Include typical tooled joint control in sample.

2. Broom Finished Concrete; Exterior Flatwork: Provide sample, 20 s.f. minimum area.

3. "Sacked" Vertical Surface; Exterior Wall: Provide sample, 5 sf. minimum area.

G. Construction Tolerances: The CONTRACTOR shall set and maintain concrete forms and perform finishing operations so as to ensure that the completed work is within the tolerances specified herein. Surface defects and irregularities are defined as finishes and are to be distinguished from tolerances. Tolerance is the specified permissible variation from lines, grades, or dimensions shown. Where tolerances are not stated in the specifications, permissible deviations will be in accordance with ACI 347.

H. Construction tolerances shall not violate dimensions, grades, slopes required by CBC for accessibility requirements. Adjust work accordingly to comply with requirements.

I. The following construction tolerances are hereby established and apply to finished walls and slab unless otherwise shown:

Item	Tolerance
Variation of the constructed linear outline from the established position in plan.	In 10 feet: 1/8-inch; In 20 feet or more: 1/4-inch
Variation from the level or from the grades shown.	In 10 feet: 1/8-inch; In 20 feet or more: 1/4-inch
Variation from the plumb	In 10 feet: 1/8-inch; In 20 feet or more: 1/4-inch
Variation in the thickness of slabs and walls.	Minus 1/8-inch; Plus 1/4-inch
Variation in the locations and sizes of slabs and wall openings.	Plus or minus 1/8-inch

PART 2 - PRODUCTS

2.01 CONSTRUCTION MATERIALS

A. Materials shall be delivered, stored, and handled so as to prevent damage by water or breakage. Only one brand of cement shall be used. Cement reclaimed from cleaning bags or leaking containers shall not be used. All cement shall be used in the sequence of receipt of shipments.

B. All materials furnished for the work shall comply with the requirements of Sections 201, 203, and 204 of ACI 301, as applicable.

C. Storage of materials shall conform to the requirements of Section 205 of ACI 301.

D. Form Materials: Plywood, metal, metal-framed plywood, or other acceptable panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces. Conform to Section 303-5.2 of the Standard Specifications.

1. Use flexible or curved forms for curves of a 100-foot or less radius.

E. Reinforcing Materials: As follows:

1. Steel Reinforcing Bars: ASTM A 615 deformed grade 40 billet steel, plain finish, unless otherwise specified on Construction Document. Fabrication, sampling and jobsite handling shall conform to the requirements in ASTM Designation: D 3963, except the 2 samples shall be 30 inches long.

2. Dowels:

   a. Dowel bars shall be plain round smooth conforming to the requirements in ASTM Designation: A 615/A 615M, Grade 40 except that the two samples required in ASTM Designation: D 3963/D 3963M shall be 18 inches long. Dowel bars shall be free from burrs or other deformations detrimental to free movement of the bars in the concrete

   b. Dowel bars shall be lubricated with a bond breaker over the entire bar. A bond breaker application of petroleum paraffin based lubricant or white-pigmented curing compound shall be used to coat the dowel bars completely prior to placement. Oil and asphalt based bond breakers shall not be used. Paraffin based lubricant shall be Dayton Superior DSC BB-Coat or Valvoline Tectyl 506 or an approved equal. Paraffin based lubricant shall be factory applied. White pigmented curing compound shall conform to the requirements of ASTM Designation: C 309, Type 2, Class A, and shall contain 22 percent minimum nonvolatile vehicles consisting of at least 50 percent paraffin wax. Curing compound shall be applied in 2 separate applications, the last application not more than 8 hours prior to placement of the dowel bars. Each application of curing compound shall be applied at the approximate rate of one gallon per 15 square yards.

3. Epoxy for bonding tie bars and dowel bars to portland cement concrete shall be a two-component, epoxy-resin, conforming to the requirements of ASTM Designation: C 881, Type V, Grade 3 (Non-Sagging), Class B or C. The class used shall be dependent on the internal temperature of the hardened concrete at the time the epoxy is to be applied. Class B shall be used when the internal temperature is from 40 °F to 60 °F. Class C shall be used when the internal temperature is above 60 °F, but not higher than recommended by the manufacturer. A copy of the manufacturer's recommended installation procedure shall be provided to the Engineer at least 7 days prior to the start of work. Epoxy shall be applied in conformance with the manufacturer's recommendations.

   a. Simpson Strong-Tie Set-XP Epoxy Adhesive (or approved equal) ICC-ES ESR-2508.

F. Concrete Materials: As follows:

1. Cement shall be standard brand portland cement conforming to ASTM C 150 for Type II. Portland cement shall contain not more than 0.60 percent alkalies. The term "alkalies" referred to herein is defined as the sum of the percentage of sodium oxide and 0.658 times the percentage of potassium oxide (Na20 + 0.658 K20). These oxides shall be determined in accordance with ASTM C 114. A single brand of cement shall be used throughout the work, and prior to its use, the brand shall be acceptable to the ENGINEER. The cement shall be suitably protected from exposure to moisture until used. Cement that has become lumpy shall not be used. Sacked cement shall be stored in such a manner so as to permit access for inspection and sampling. Certified mill test reports for each shipment of cement to be used shall be submitted to the INSPECTOR.

2. Concurrent with strength design criteria, concrete shall also be proportioned to provide the requisite durability to satisfy the exposure conditions imposed by either environment and/or

service. Durability, in this context, refers to the ability of the concrete to resist deterioration from the environment or service in which it is placed. Concrete proportioned in accordance with ACI 318, chapter 4, Durability Requirements, will meet this criteria.

3. Combined Aggregate: 1" maximum coarse aggregate size conforming to Grading C of Standard Specifications Section 201-1.3.2(A). Aggregates shall be obtained from pits acceptable to the INSPECTOR, shall be non-reactive, and shall conform to ASTM C 33.

4. Water: Shall be potable, clean, and free from objectionable quantities of silty organic matter, alkali, salts and other impurities. The water shall be considered potable, for the purposes of this Section only, if it meets the requirements of the local governmental agencies.

5. ***"Pea gravel" mix is not acceptable,*** unless specifically approved in writing by the Civil Engineer of Record prior to construction.

G. Admixtures:

1. The ENGINEER may require the use of admixtures or the CONTRACTOR may propose to use admixtures to control the set, effect water reduction, and increase workability. In either case, the addition of an admixture shall be at the CONTRACTOR's expense. The use and continued use of an admixture shall be approved by the ENGINEER. Admixtures specified herein, other than calcium chloride, shall conform to the requirements of ASTM C 494. The required quantity of cement shall be used in the mix regardless of whether or not an admixture is used. Admixtures shall contain no free chloride ions, be non-toxic after 30 days, and shall be compatible with and made by the same manufacturer as the air entraining admixture.

2. These admixtures shall not be used in greater doses than those recommended by the manufacturer or permitted by the ENGINEER. The permitted dosage of the admixture shall not exceed that which will result in an increase in the driving shrinkage of the concrete in excess of 20 percent when used in precast or prestressed concrete, or 10 percent when used in any other structural concrete. The strength of concrete containing the admixture in the amount of proposed shall, at the age of 48 hours and longer be not less than that of similar concrete without the admixture. The admixture shall not adversely affect the specified air content, unless permitted by the ENGINEER.

3. Set controlling admixture shall be either with or without water-reducing properties. Where the air temperature at the time of placement is expected to be consistently over 80 degrees F, a set retarding admixture such as [Sika Chemical Corporation's Plastiment], [Master Builder's Pozzolith 300R], or equal shall be used. Where the air temperature at the time of placement is expected to be consistently under 40 degrees F, a set accelerating admixture such as [Sika Chemical Corporation's Plastocrete 161FL], [Master Builder's Pozzolith 50C], or equal shall be used.

4. Low range water reducer shall conform to ASTM C 494, Type A. It shall be either a hydroxylated carboxylic acid type or a hydroxylated polymer type. The quantity of admixture used and the method of mixing shall be in accordance with the manufacturer's instructions and recommendations.

5. High range water reducer shall be sulfonated polymer conforming to ASTM C 494, Type F or G.

   a. If the high range water reducing agent is added to the concrete at the batch plant, it shall be second generation type, [Daracem 100, as manufactured by W.R. Grace & Co.]; [Pozzolith 430R, as manufactured by Masterbuilders]; or equal. High range

water reducer shall be added to the concrete after all other ingredients have been mixed and initial slump has been verified.

b. If the high range water reducer is added to the concrete at the job site, it shall be used in conjunction with a low range water reducer and shall be [Pozzolith 400N and Pozzolith MBL82, as manufactured by Masterbuilders]; [WRDA 19 and WRDA 79, as manufactured by W.R. Grace & Co.]; or equal. Concrete shall have a slump of 3-inches ± 1/2-inch prior to adding the high range water reducing admixture at the job site. The high range water reducing admixture shall be accurately measured and pressure injected into the mixer as a single dose by an experienced technician. A standby system shall be provided and tested prior to each day's operation of the job site system.

6. Air-entraining agent meeting the requirements of ASTM C 260, shall be used. Sufficient air-entraining agent shall be used to provide a total air content of 3 to 4 percent; provided that, when the mean daily temperature in the vicinity of the worksite falls below 40 degrees F for more than one day, the total air content provided shall be 5 to 6 percent. The Owner reserves the right, at any time, to sample and test the air-entraining agent received on the job by the CONTRACTOR. The air-entraining agent shall be added to the batch in a portion of the mixing water. The solution shall be batched by means of a mechanical batcher capable of accurate measurement.

7. Calcium Chloride: Except as otherwise provided herein, calcium chloride will not be permitted to be used in concrete.

8. Fly ash/pozzolan shall conform to ASTM C 618 and the following supplementary requirements:

a. Class F fly ash

o Loss on ignition,	maximum 4 percent
o S03 content,	maximum 3 percent
o Moisture content,	maximum 1 percent

b. Class F fly ash, as a percent by weight of total cementitious material, shall not exceed 20 percent

c. When Sulfate Resistant or Special Exposure Concrete is specified, test results shall be submitted to the Engineer as specified in Section 2-5.3 of the Standard Specifications. The test result shall show that the fly ash to be used is effective in contributing to sulfate resistance in conformance with ASTM C618, Table 3 (optional physical requirements) as tested in accordance with ASTM C 1012. The data submitted shall be less than 6 months old.

H. Curing Materials:

1. Concrete curing compound shall conform to the requirements of ASTM C309 Type 1-D (clear or translucent with a fugitive dye), Class B (Resin Type Only), except the loss of water shall not exceed 0.15 kilograms per square meter in 24 hours nor 0.45 kilograms per square meter in 72 hours when tested in accordance with ASTM C 156. The CONTRACTOR shall provide, when requested by the ENGINEER, certified copies of vendor's test report showing compliance with ASTM C 309 and these specifications. The testing and the report shall be supplied without cost to the Agency. All compounds shall be furnished by the CONTRACTOR in sealed original containers labeled in accordance with ASTM C 309 and with the date of manufacture.

2. Polyethylene sheet for use as concrete curing blanket shall be white and conform to ASTM C 171. The loss of moisture when determined in accordance with the requirements of ASTM C 156 shall not exceed 0.055 grams per square centimeter of surface.

3. Polyethylene-coated burlap for use as concrete curing blanket shall conform to ASTM C 171. The loss of moisture, when determined in accordance with the requirements of ASTM C 156, shall not exceed 0.055 grams per square centimeter of surface.

I. Expansion Joint Filler Material

1. Curb & Gutter: Nonextruding and Resilient Filler: Celotex "Flexcell", or approved equal, 1/4-inch thick material conforming to ASTM D 1751.

2. Concrete Walk and Slab: Joint filler material shall be preformed expansion joint filler conforming to the requirements of ASTM D994. A Certificate of Compliance for the joint filler material shall be furnished to the Engineer. The certificate shall be accompanied with a certified test report of the results of the required tests performed on the joint filler material within the previous 12 months prior to proposed use. The certificate and accompanying test report shall be provided for each lot of joint filler material prior to use on the project.

3. Silicone Joint Sealant: Premium-grade, high-performance, moisture-cured, single-component, polyurethane-based, non-sag elastomeric sealant. Meets Federal specification TT-S-00230C. Meets ASTM C-920, Type S, Class 25 or 35; Grade NS, Use T or NT, Shore A Hardness (21 day) 35-45. A Certificate of Compliance for the silicone sealant shall be furnished to the Engineer. The Certificate shall also be accompanied with a certified test report of the results of the required tests performed on the sealant material within the previous 12 months prior to proposed use. The Certificate and accompanying test report shall be provided for each lot of silicone joint sealant prior to use on the project.

a. Sika Corporation, Sikaflex-1A.

b. Tremco, Inc., Dymonic.

c. Tremco, Inc., Vulkem 116.

d. Bostik Construction Products Div., Chem-Calk 900.

J. Concrete Sealer: For natural color concrete only, HLQ-125 as manufactured by SINAK Corp., San Diego, CA (619/231-1771), HLQ-125 as manufactured by SINAK Corp., San Diego, CA (619/231-1771), or equivalent product of another manufacturer in accordance with the "or equal" provision of the Contract Documents, penetrating sealer that interacts with mineral compounds and siliceous materials in portland cement concrete to produce more dense, non-dusting surface.

K. Related Materials: As follows:

1. Damp-proofing agent shall be an asphalt emulsion, such as [Sonneborn Hydrocide 660], [Flintkote C-13-E Foundation Coating], or equal.

2. Epoxy adhesives shall be the following products for the applications specified:

a. For bonding freshly-mixed, plastic concrete to hardened concrete, [Sikadur Hi-Mod Epoxy Adhesive, as manufactured by Sika Chemical Corporation]; [Concresive 1001-LPL, as manufactured by Adhesive Engineering Company]; or equal.

b. For bonding hardened concrete or masonry to steel, [Colma-Dur Gel], [Sikadur Hi-Mod Gel], or equal.

L. Flatwork, Curbs / Curb & Gutter Mix Design: At a minimum, concrete for flatwork, curbs and curbs & gutters shall conform to the Standard Specifications for Public Works Construction, Section 201-1.1.2, mix class 560-C-3250:

1. Compressive Strength: minimum of 3,250 psi at 28 days compressive strength.

2. Slump Limit: 4 inches at point of placement.

3. Cement per cu yard (sacks): 6.0 (minimum).

4. Air Content: 4% +/- 1% percent.

M. Slurry Mix Design:

1. Compressive Strength: 200 psi at min. 28 days compr. strength.

2. Slump Limit: 5 inches at point of placement.

3. Cement per cu yard (sacks): 2.0

4. Aggregate Gradation: "E" per S.S.P.W.C. table 201-1.3.2(A).

PART 3 - EXECUTION

3.01 PREPARATION OF SURFACES FOR CONCRETING

A. General: Earth surfaces shall be thoroughly wetted by sprinkling, prior to the placing of any concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. The surface shall be free from standing water, mud, and debris at the time of placing concrete.

B. Subgrade Preparation:

1. See project soils report section 4.1.2 for subgrade preparation requirements.

C. The compacted surface shall be firm, hard and unyielding. The term "firm, hard and unyielding" as used in S.S.P.W.C. Section 301-1.3 shall mean that when the heaviest construction and hauling equipment used on the project drives over the subgrade, no permanent deformation shall occur either before or during pavement construction. On areas where the underlying material appears to be wet or soft, or where it deflects under wheel loads, the Contractor shall employ excavation and work techniques which do not worsen the subgrade condition.

D. The above subgrade preparation recommendations are based on the assumption that soils encountered during field exploration are representative of soils throughout the site. However, there can be unforeseen and unanticipated variations in soils between points of subsurface exploration. For this reason, the actual scarification or over-excavation depths will have to be determined on the basis of in-grading observations and testing performed by representatives of the project geotechnical consultant.

E. A California Licensed Surveyor (LS) must provide grade stakes and elevations for the Geotechnical Engineer to verify that the over-excavation depths, shown on the construction drawings for concrete pavement structural sections, have been achieved prior to re-compaction.

F. Joints in Concrete: Concrete surfaces upon or against which concrete is to be placed, where the placement of the old concrete has been stopped or interrupted so that, as determined by the ENGINEER, the new concrete cannot be incorporated integrally with that previously placed, are defined as construction joints. The surfaces of horizontal joints shall be given a compacted, roughened surface for good bond. Except where the Drawings call for joint surfaces to be coated, the joint surfaces shall be cleaned of all laitance, loose or defective concrete, and foreign material. Such cleaning shall be accomplished by sandblasting followed by thorough washing. All pools of water shall be removed from the surface of construction joints before the new concrete is placed.

G. Embedded Items: No concrete shall be placed until all formwork, installation of parts to be embedded, reinforcement steel, and preparation of surfaces involved in the placing have been completed and ACCEPTED by the INSPECTOR at least 24 hours before placement of concrete. All surfaces of forms and embedded items that have become encrusted with dried grout from concrete previously placed shall be cleaned of all such grout before the surrounding or adjacent concrete is placed.

H. All inserts or other embedded items shall conform to the requirements herein.

I. All reinforcement, anchor bolts, sleeves, inserts, and similar items shall be set and secured in the forms where shown or by shop drawings and shall be acceptable to the INSPECTOR before any concrete is placed. Accuracy of placement is the responsibility of the CONTRACTOR.

J. Where concrete is to be cast against old concrete, (greater than 60 days of age), the surface of the old concrete shall be thoroughly cleaned and roughened by sand-blasting, exposing the aggregate. In concrete shear-walls, suspended slabs and roof slabs, the interface surface at construction joints shall be roughened to a full amplitude of one quarter inch. The hardened surface shall be cleaned of all latent foreign material and washed clean, prior to the application of an epoxy bonding agent.

K. No concrete shall be placed in any structure until all water entering the space to be filled with concrete has been properly cut off or has been diverted by pipes, or other means, and carried out of the forms, clear of the work. No concrete shall be deposited underwater nor shall the CONTRACTOR allow still water to rise on any concrete until the concrete has attained its initial set. Water shall not be permitted to flow over the surface of any concrete in such manner and at such velocity as will injure the surface finish of the concrete. Pumping or other necessary dewatering operations for removing ground water, if required, will be subject to the review of the ENGINEER.

L. Corrosion Protection: Pipe, conduit, dowels, and other ferrous items required to be embedded in concrete construction shall be so positioned and supported prior to placement of concrete that there will be a minimum of 2-inches clearance between said items and any part of the concrete reinforcement. Securing such items in position by wiring or welding them to the reinforcement will not be permitted.

M. Openings for pipes, inserts for pipe hangers and brackets, and the setting of anchors shall, where practicable, be provided for during the placing of concrete.

N. Anchor bolts shall be accurately set, and shall be maintained in position by templates while being embedded in concrete.

O. Cleaning: The surfaces of all metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before the concrete is placed.

3.02 HANDLING, TRANSPORTING, AND PLACING

A. General: Placing of concrete shall conform to the applicable requirements of ACI 301 and the requirements of this Section.

B. The total elapsed time between the addition of water at the batch plant and the completion of the discharge of the P.C.C. from the mixer shall not exceed 90 minutes. All P.C.C. remaining in the mixer after said 90-minute time limit shall be rejected and removed from the project site.

C. Non-Conforming Work or Materials: Concrete which upon or before placing is found not to conform to the requirements specified herein shall be rejected and immediately removed from the work. Concrete which is not placed in accordance with these Specifications, or which is of inferior quality, shall be removed and replaced by and at the expense of the CONTRACTOR.

D. Whenever batch trucks or other paving equipment cause rutting of the subgrade or subbase in concrete placement areas, inspectors shall immediately stop construction. Construction shall not be allowed to resume until distorted subgrade or subbase is repaired. Contractors and inspectors should locate by proof rolling, any questionable unstable areas in advance to avoid distortion under equipment. Wet, unstable areas must be dried out or replaced before starting placement of asphalt. Locating wet or soft areas in advance can be accomplished by testing finished subgrade or subbase with a loaded truck. Construction of concrete pavement should not proceed unless testing gives a reasonable indication that distortions will not occur during construction of overlying pavement. When repair, aeration, and recompaction are required to correct damage from Contractor's operation, all necessary repair will be done at Contractor's expense. However, if the Engineer determines that additional depth of aeration and recompaction are needed, that should be paid by change order.

E. All pull boxes, meter boxes, valve covers and manholes shall be adjusted to proposed finish grade prior to placement of the P.C.C.

F. Dowel Placement:

1. Dowel bars shall be centered on the joint within a tolerance of ±2 inches in the longitudinal direction directly over the contact joint or sawcut for the transverse weakened plane joints, as shown on the plans. Prior to placement of dowel bars, the Contractor shall submit to the Engineer a written procedure to identify the transverse weakened plane joint locations relative to the middle of the dowel bars and the procedure for consolidating concrete around the dowel bars.

2. Dowel bars shall be placed at longitudinal joints as shown on the plans. Dowel bars shall be placed as shown on the plans by using mechanical insertion. When dowel bars are placed by mechanical insertion, the concrete over the dowel bars shall be reworked and refinished so that there is no evidence on the surface of the completed pavement that there has been any insertion performed. When drill and bonding of dowel bars is performed at contact joints, a grout retention ring shall be used.

G. Concrete shall not be placed until the forms and reinforcement have been inspected, all preparations for the placement have been completed, and the preparations have been checked by the project inspector, all subject to the observation of the engineer or architect.

H. Casting New Concrete Against Old: An approved epoxy adhesive bonding agent shall be applied to the old surfaces according to the manufacturer's written recommendations. This provision shall not apply to joints where waterstop is installed.

I. Conveyor Belts and Chutes: All ends of chutes, hopper gates, and all other points of concrete discharge throughout the CONTRACTOR'S conveying, hoisting and placing system shall be so designed and arranged that concrete passing from them will not fall separated into whatever receptacle

immediately receives it. Conveyor belts, if used, shall be of a type acceptable to the INSPECTOR. Chutes longer than 50 feet will not be permitted. Minimum slopes of chutes shall be such that concrete of the specified consistency will readily flow in them. If a conveyor belt is used, it shall be wiped clean by a device operated in such a manner that none of the mortar adhering to the belt will be wasted. All conveyor belts and chutes shall be covered. Sufficient illumination shall be provided in the interior of all forms so that the concrete at the places of deposit is visible from the deck or runway.

J. Placement in Slabs: Concrete placed in sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the pour. As the work progresses, the concrete shall be vibrated and carefully worked around the slab reinforcement, and the surface of the slab shall be screeded in an up-slope direction.

K. Temperature of Concrete: The temperature of concrete when it is being placed shall be not more than 90 degrees F nor less than 40 degrees F in moderate weather, and not less than 50 degrees F in weather during which the mean daily temperature drops below 40 degrees F. Concrete ingredients shall not be heated to a temperature higher than that necessary to keep the temperature of the mixed concrete, as placed, from falling below the specified minimum temperature. If concrete is placed when the weather is such that the temperature of the concrete would exceed 90 degrees F, the CONTRACTOR shall employ effective means, such as precooling of aggregates and mixing water using ice or placing at night, as necessary to maintain the temperature of the concrete, as it is placed, below 90 degrees F. The CONTRACTOR shall be entitled to no additional compensation on account of the foregoing requirements.

L. Cold Weather Placement: Earth foundations shall be free from frost or ice when concrete is placed upon or against them. Fly ash concrete shall not be placed when the air temperature falls below 50 degrees F.

M. A transverse construction joint shall be constructed, including dowel bars, at the end of each day's work or where concrete placement is interrupted for more than 30 minutes, to coincide with the next contraction joint location. If sufficient concrete has not been mixed to form a slab to match the next contraction joint, when an interruption occurs, the excess concrete shall be removed and disposed of back to the last preceding joint. The cost of removing and disposing of excess concrete shall be at the Contractor's expense. Excess material shall become the property of the Contractor and shall be disposed of. A metal or wooden bulkhead (header) shall be used to form the joint. The bulkhead shall be designed to accommodate the installation of dowel bars.

N. Float Finish: Begin floating when bleed water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surfaces to true planes within a tolerance of 1/4 inch in 10 feet as determined by a 10-foot-long straightedge placed anywhere on the surface in any direction. The finished surface shall be free from humps, sags, blemishes or other irregularities Cut down high spots and fill low spots. Refloat surface immediately to a uniform granular texture.

O. Broom Finish Type:

1. Surfaces Sloped Less than 6%: Provide a medium salt (medium broom) finish by drawing a soft bristle broom across concrete surface, perpendicular to line of traffic, to provide a uniform fine line texture.

2. Surfaces Sloped greater than 6%: Provide a slip resistant (heavy broom finish) by striating surface 1/16 inch to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

P. Joints:

1. Joints: Joints in concrete curb, gutter, and walk shall be designated as expansion joints and control joints. Joints for concrete flatwork shall be provided every five (5) feet or less. Expansion joints for swales, curbs / curb & gutter shall be placed at no greater than 15 feet on center or as indicated on construction drawings.

    a. Expansion Joints: Provide 1/2" premolded joint filler, material meeting Section 2.01I herein. Construct expansion joints in conformance with Standard Specification Section 303-5.4.2 and the details on the construction documents.

        1) Extend expansion joint fillers full-width and depth of joint, and 1/4" below finished surface where joint filler is indicated. If no joint sealer is called for, place top of premolded joint filler flush with top of concrete or curb.

        2) Where silicone joint sealer is noted on the construction documents, the premolded joint filler strips shall be placed 1" below the surface of the concrete or curb, the full width of the expansion joint. The remainder of all joints shall be filled to within 1/4" below the surface of the concrete with the silicone joint sealant.

        3) Provide expansion joint filler strips, with elastomeric sealer, between p.c.c. walk and curb, p.c.c. walk and buildings, & p.c.c. walk and retaining walls and at locations noted on the construction documents. The depth of the filler strip shall be the depth of the p.c.c. walk plus 1 inch with the top set flush with the specified grade of the top of curb or walk.

    b. Control Joints:

        1) Control joints in site work concrete shall comply with Standard Specification Section 302-6.5.4, except that the configuration of the joint, shall be as indicated on the construction documents.

        2) Control joints in concrete curbs, sidewalks and gutters shall comply with Standard Specification Section 303-5.4.3, except that the joint configuration shall be as indicated below.

        3) Location: As shown on construction documents. In swales and gutters, including gutter integral with curb, joints shall be at regular intervals not exceeding 10 (10) feet. Where integral curb and gutter is adjacent to concrete pavement, the joint shall be aligned with the pavement joints where practical.

Q. Protection: In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control film. Apply according to manufacturer's instructions after screeding and bull floating, but before floating.

3.03 LIGHT STANDARD BASES, FLAGPOLE BASES, POST BASES AND SIMILAR SITE STRUCTURES

A. Forms: Suitable material and type, size, shape, quality and strength to insure construction as designed, true to line and sufficiently rigid to resist deflection during placing of concrete. Clean forms of all dirt, mortar and foreign matter before use.

B. Reinforcement: Place accurately and hold in position, using metal chairs, spacers, metal hangers, supporting wires and other devices of sufficient strength to resist crushing under full load. Clean reinforcing steel of mortar, oil, dirt, loose mill scale loose or thick rust and coatings.

C. Coordinate installation of conduits, cast in place items and other inserts.

D. Finish: Grind or sack as required as determined by the Architect to produce a smooth, straight, plumb and acceptable finish without burrs or form marks. For horizontal surfaces: provide float finish.

E. Curing: Cure surfaces utilizing one of the following methods:

1. Spraying: Spray water over slab areas and maintain wet for 7 days.

2. Spread polyethylene film over slab areas, lapping edges and sides, minimum 6 inches and sealing with pressure sensitive tape; cover with plywood or otherwise protect film from damage; maintain in place for 7 days.

3. Apply liquid curing compound at rate of 200 square feet per gallon, using power sprayer equipped with agitator. Do not apply liquid curing compound to surfaces scheduled to receive paving units or finish of any kind.

3.04 TAMPING AND VIBRATING

A. As concrete is placed in the forms or in excavations, it shall be thoroughly settled and compacted, throughout the entire depth of the layer which is being consolidated, into a dense, homogeneous mass, filling all corners and angles, thoroughly embedding the reinforcement, eliminating rock pockets, and bringing only a slight excess of water to the exposed surface of concrete during placement. Vibrators shall be high speed power vibrators (8000 to 10,000 rpm) of an immersion type in sufficient number and with (at least one) standby units as required.

B. Care shall be used in placing concrete around waterstops. The concrete shall be carefully worked by rodding and vibrating to make sure that all air and rock pockets have been eliminated. Where flat-strip type waterstops are placed horizontally, the concrete shall be worked under the waterstops by hand, making sure that all air and rock pockets have been eliminated. Concrete surrounding the waterstops shall be given additional vibration, over and above that used for adjacent concrete placement to assure complete embedment of the waterstops in the concrete.

C. Concrete in walls shall be internally vibrated and at the same time rammed, stirred, or worked with suitable appliances, tamping bars, shovels, or forked tools until it completely fills the forms or excavations and closes snugly against all surfaces. Subsequent layers of concrete shall not be placed until the layers previously placed have been worked thoroughly as specified. Vibrators shall be provided in sufficient numbers, with standby units as required, to accomplish the results herein specified within 15 minutes after concrete of the prescribed consistency is placed in the forms. The vibrating head shall be kept from contact with the surfaces of the forms. Care shall be taken not to vibrate concrete excessively or to work it in any manner that causes segregation of its constituents.

3.05 CURING

A. Comply with 2016 California Building Code, Title 24, Part 2, Volume 2, Section 1905A.11.

1. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least seven (7) days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

B. Curing Methods: Perform curing of concrete by curing as herein specified.

1. Provide moisture-curing by the following methods:

a. Keep concrete surface continuously wet by covering with water.

b. Continuous water-fog spray.

c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4 inch lap over adjacent absorptive covers.

2. Provide curing and sealing compound to exposed exterior slabs, walks, and curbs, as follows:

a. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Re-coat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

b. Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid, floor hardener, waterproofing, dampproofing, membrane roofing, flooring (such as ceramic or quarry tile, glue-down carpet), painting, and other coatings and finish materials, unless otherwise acceptable to Architect.

C. Concrete slabs and paving shall be properly cured and protected against damage and defacement of nature during construction operations. If weather is hot or surface has dried out, spray surface with fine mist of water starting not later than two hours after final troweling. Surface of finish shall be kept continuously wet for at least ten days. Wetting is considered emergency work and shall be performed on weekends and holidays if necessary.

D. Concrete Sealer Application: Apply specified concrete sealer in continuous operation in accordance with manufacturer's instructions and recommendations.

1. Prior to starting application, protect adjoining Work, including sealant bond surfaces, from spillage or blow-over of concrete sealer.

a. Cover adjoining and nearby surfaces of aluminum and glass where there is the possibility of the concrete sealer being deposited on surfaces.

b. Cover live plants and grass.

c. Immediately clean concrete sealer from adjoining surfaces, complying with manufacturer's cleaning recommendations.

2. Apply concrete sealer under temperature conditions according to manufacturer's instructions.

3. Apply concrete sealer in light, even coats using garden sprayer, airless sprayer or paint brush.

4. Apply concrete sealer at rate to suit porosity of portland cement concrete but not less than no more than coverage rates recommended by manufacturer for effective sealing of surface.

E. Integrally Colored Concrete: Apply curing and sealing compound for integrally colored concrete according to manufacturer's instructions using manufacturer’s recommended application techniques. Apply curing and sealing compound at consistent time for each pour to maintain close color consistency.

a. Curing compound shall be same color as the colored concrete and supplied by same manufacturer of the colored admixture.

b. Precautions shall be taken in hot weather to prevent plastic cracking resulting from excessively rapid drying at surface as described in CIP 5 *Plastic Shrinkage Cracking* published by the National Ready Mixed Concrete Association.

c. Do not cover concrete with plastic sheeting.

F. The CONTRACTOR shall protect all concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance by the Owner. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at any time prior to the final acceptance of the completed work, or which departs from the established line or grade, or which, for any other reason, does not conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete at the CONTRACTOR'S expense. Exclude traffic from concrete paving for at least 7 days after placement.

G. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep concrete paving not more than 2 days prior to date scheduled for Substantial Completion inspections.

3.06 PUMPING OF CONCRETE

A. General: If the pumped concrete does not produce satisfactory end results, the CONTRACTOR shall discontinue the pumping operation and proceed with the placing of concrete using conventional methods.

B. Pumping Equipment: The pumping equipment must have 2 cylinders and be designed to operate with one cylinder only in case the other one is not functioning. In lieu of this requirement, the CONTRACTOR may have a standby pump on the site during pumping.

C. The minimum diameter of the hose (conduits) shall be 4-inches.

D. Pumping equipment and hoses (conduits) that are not functioning properly, shall be replaced.

E. Aluminum conduits for conveying the concrete will not be permitted.

F. Proportioning: Minimum compressive strength, cement content, and maximum size of aggregates shall be as specified herein.

G. Gradation of coarse aggregates shall conform to ASTM C 33 and shall be as close to the middle range as possible.

H. Gradation of fine aggregate shall conform to ASTM C 33, with 15 to 30 percent passing the number 50 screen and 5 to 10 percent passing the number 100 screen. The fineness modulus of sand used shall not be over 3.00.

I. Water and slump requirements shall conform to the requirements of this Section.

J. Cement and admixtures shall conform to the requirements of this Section.

K. Field Control: Concrete samples for slump per ASTM C 143 and test cylinders per ASTM C 31 and C 39.

3.07 TREATMENT OF SURFACE DEFECTS

A. As soon as forms are removed, all exposed surfaces shall be carefully examined and any irregularities shall be immediately rubbed or ground in a satisfactory manner in order to secure a smooth, uniform, and continuous surface. Plastering or coating of surfaces to be smoothed will not be permitted. No repairs shall be made until after inspection by the ENGINEER. In no case will extensive patching of honeycombed concrete be permitted. Concrete containing minor voids, holes, honeycombing, or similar depression defects shall have them repaired as specified herein. Concrete containing extensive voids, holes, honeycombing, or similar depression defects, shall be completely removed and replaced.

1. All repairs and replacements herein specified shall be promptly executed by the CONTRACTOR at its own expense.

B. Defective surfaces to be repaired shall be cut back from trueline a minimum depth of 1/2-inch over the entire area. Feathered edges will not be permitted. Where chipping or cutting tools are not required in order to deepen the area properly, the surface shall be prepared for bonding by the removal of all laitance or soft material, and not less than 1/32-inch depth of the surface film from all hard portions, by means of an efficient sandblast. After cutting and sandblasting, the surface shall be wetted sufficiently in advance of shooting with shotcrete or with cement mortar so that while the repair material is being applied, the surfaces under repair will remain moist, but not so wet as to overcome the suction upon which a good bond depends. The material used for repair purposes shall consist of a mixture of one sack of cement to 3 cubic feet of sand. For exposed walls, the cement shall contain such a proportion of Atlas white portland cement as is required to make the color of the patch match the color of the surrounding concrete.

C. Holes left by tie-rod cones shall be reamed so as to leave the surfaces of the holes clean and rough. These holes then shall be repaired in an approved manner with non-shrink grout. Holes left by form-tying devices having a rectangular cross-section, and other imperfections having a depth greater than their least surface dimension, shall not be reamed but shall be repaired in an approved manner with non-shrink grout.

D. All repairs shall be built up and shaped in such a manner that the completed work will conform to the requirements of this Section, as applicable, using approved methods which will not disturb the bond, cause sagging, or cause horizontal fractures. Surfaces of said repairs shall receive the same kind and amount of curing treatment as required for the concrete in the repaired section.

E. Prior to filling any structure with water, all cracks that may have developed shall be repaired to the satisfaction of the ENGINEER. This repair method shall be done on the water bearing face of members. Prior to backfilling, faces of members in contact with fill, which are not covered with a waterproofing membrane, shall also have cracks repaired as specified herein.

F. The finished surface shall be free from humps, sags, blemishes or other irregularities.

3.08 FIELD QUALITY CONTROL

A. Correction of Mix Design for Failed Concrete Tests: If the compressive cylinder strength test for in place PCC yields test results below the specified 28-day PCC compressive strength and the Engineer determines a corrective change is necessary, the Contractor shall, at its own expense, make corrective changes in the mix proportions. The Engineer shall approve the changes in the mix proportions or PCC placement procedures, before any additional PCC is placed on the job.

B. Flood Tests: Before final acceptance, and after concrete has thoroughly cured, all concrete pavement, including swales and curb & gutter, shall be water tested to ensure proper drainage as directed by the Inspector. The Contractor shall provide water for this purpose. The flooding shall be done by water tank truck. Concrete work where water ponds and does not run off in a reasonable amount of time (1-hour), shall be removed to the nearest score or joint line and replaced to provide proper drainage. Full

compensation for complying with this requirement shall be considered as included in the Contract Unit Price for cement concrete pavement.

3.09 CARE AND REPAIR OF CONCRETE

A. General: The CONTRACTOR shall protect all concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance by the Owner. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at any time prior to the final acceptance of the completed work, or which departs from the established line or grade, or which, for any other reason, does not conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete at the CONTRACTOR'S expense.

B. The contractor shall barricade and protect placed Portland Cement Concrete from all damage, marks, mars and/or graffiti. Any Portland Cement Concrete damaged, defaced, discolored or defective shall be replaced at the contractor’s expense.

END OF SECTION 321313

This page intentionally left blank.

SECTION 32 13 16 - DECORATIVE SITE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes colored and natural gray retardant finish concrete paving, concrete stairs, ramps, curbs and gutter and concrete bands, headers and finish for concrete site walls.

B. Related Sections:
1. Section 03 30 00 "Cast-in-Place Concrete" for general building applications of concrete.

1.3 SUBMITTALS

A. See section 01 30 00 – Administrative Requirements, for submittal procedures.

B. Product Data:
1. For each type of product indicated submit manufacturer's product data, specifications, typical installation details and other data to demonstrate compliance with the specified requirements for all manufacturer products.
2. Statement of Mix Design: Submit (3) copies of Statement of Mix Design prepared by batch plant servicing Project for each load delivered to Project. Statement of Mix Design to contain following information:
   a. Name, address, and telephone number of batch plant preparing statement of mix design.
   b. Date of mix design.
   c. Project location.
   d. Contractor requesting load delivery.
   e. Mix design number.
   f. Integral color used.
   g. Gradations for sand and aggregate.
   h. Material weights, specific gravity, and absolute volumes.
   i. Basis of testing, i.e. UBC 2605 D4 and Title 24 2604 D4.
   j. Water/cement ratio.
   k. PSI rating.
   l. Signature of testing laboratory manager.
   m. Signed stamp from registered Project structural engineer or architect LEED Submittals.

C. Material Certificates: For the following, from manufacturer:
1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or epoxy adhesive.
8. Joint fillers.

D. Samples for Verification: To be determined by the mock-ups.

E. Shop Drawings:
1. Indicate layout of joints.
2. Submit shop drawings for reinforcing steel and accessories in accordance with ACI standards.
3. Paving Jointing and Pour Sequence Plan - submit three full size bond prints of each paving sheet indicating the following:
   a. Proposed layout of contraction, construction and isolation joints. Clearly delineate the three different joint types.
   b. Layout of paving types as indicated on Drawing Paving Schedule. Give overall dimensions of each paving type.
   c. Concrete pour sequence. Indicated sequence of paving pour installation.

F. Qualification Data: For qualified Installer.

1.4 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For the following, from manufacturer:
1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or epoxy adhesive.
8. Joint fillers.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm and individuals trained and approved by manufacturer of decorative concrete paving systems with a minimum of fifteen consecutive years' experience. Provide written evidence to indicate successful experience in installing Intecrete or equivalent architectural concrete paving, or similar, on at least (5) projects with a combined installed square footage of at least 75,000 SF with (3) projects located within a 100 mile radius of Project site.

B. ACI Certified Personnel:
1. Concrete Flatwork Finisher:
   a. Minimum of 1,500 hours of field experience having installed at least (5) projects containing Intecrete® architectural concrete paving.
   b. Must be present during important stages of concrete production such as layout, formwork, or concrete placement and finishing.
   c. Project must have a minimum of (1) ACI certified Concrete Flatwork Finisher at important phases of production.
   d. Submit verification of current ACI certification.
2. Concrete Flatwork Technician:
   a. Minimum of (1) ACI certified Concrete Flatwork Technician able to render technical assistance on project, if requested.
   b. Submit verification of current ACI certification.

C. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

D. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

E. Source Limitations: Obtain decorative concrete paving products and each type or class of cementitious material of the same brand from same manufacturer's plant, and obtain each aggregate from single source.

F. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.

G. ACI Publications: Comply with ACI 301 (ACI 301M) unless otherwise indicated.

H. Mockups:
   1. Prepare on-site paving and stair mock-ups as follows:
      a. Prepare a minimum 8-foot square mock-up of each different paving type specified on Drawings. Label mock-ups (preferably on vertical side of mock-up) with specified paving type to facilitate mock-up review.
      b. Construct mock-ups using identical concrete mix design, products, jointing, and methods of overall workmanship that will be employed during production.
      c. Ensure that same crew preparing mock-ups will be responsible for production work.
      d. Construct mock-ups in a protected location approved by Owner. Ideally mock-ups should be located as close to production work as possible to facilitate comparison review and be located in a sunny location.
      e. Approved mock-ups will be used as standard for future production work review and assessment. Owner should be prepared to physically sign mock-up using a permanent black marker to attest Owner’s approval of mock-up. Rejected mock-ups can remain on-site until removal of approved mock-ups is required.
      f. Original 6-inch or 12-inch concrete samples, if they were prepared for this project, will not be used in future production paving review once mock-ups have been approved.
      g. Owner will incur costs to redo mock-ups if Owner requires design changes during mock-up review. Contractor will incur costs to redo mock-ups if Owner rejects mock-ups due to Contractor error such as incorrect concrete mix design or unacceptable appearance.
      h. Protect approved mock-ups from damage during course of Work.
      i. i. Clean mock-ups prior to Final Walkthrough for Acceptance to facilitate unencumbered comparison review by Owner between approved mock-ups and production work.
      j. k. Remove mock-ups from site when directed by Owner.
   2. Prepare site wall mock-ups as follows:
      a. Minimum 5-foot long mock-up of each specific Wall type indicated on Drawings.
      b. Construct mock-ups using products, materials and workmanship methods identical to those that will be employed during production. Workmanship to exhibit finish, jointing, and edging.
      c. Use same concrete mix that will be used during production.
      d. Ensure that same personnel that prepared mock-ups will also install production work.
      e. Construct mock-ups in a location approved by General Contractor.
      f. Approved wall mock-ups will be standard for assessment for future production work.

g. Construct additional mock-ups at Contractor's expense if workmanship is responsible for mock-up rejection by Owner, however, Owner will incur costs to redo mock-up if Owner requests design changes during mock-up preparation.
h. Protect approved mock-ups during course of Work.
i. Remove mock-ups from site when directed by General Contractor.

I. Preinstallation Conference: Conduct conference at Project site.
1. At least three weeks prior to ordering specified materials or the start of concrete work,
2. Arrange a pre-installation meeting between the Contractor, Architect, Project superintendent, concrete supplier, and concrete finisher to review finishing techniques of
3. Concrete, use of additives, application of curing compounds and coordination with other
4. trades.

1.7 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 FLAT WORK FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
1. Use flexible or uniformly curved forms for curves of a radius of 100 feet (30.5 m) or less. Do not use notched and bent forms.

B. Forms for Textured Finish Concrete: Units of face design, size, arrangement, and configuration indicated. Provide solid backing and form supports to ensure stability of textured form liners.

C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.2 FORM MATERIALS

A. Plywood:
1. Exterior grade plywood panels, non-absorptive, providing a continuous, true, and smooth surface such as medium-density overlay (MDO), Class 1, or better, with mill-applied release agent and sealed edges.
2. Form Joint Tape: Pressure-sensitive compressible foam tape.
3. Form-Release Agent: Colorless form-release agent that will not bond with concrete surface or impair subsequent treatments of those surfaces.

B. Structural:
1. #2 Construction Grade S4S Douglas Fir minimum 1-1/2-inches thick, free of warping, loose knots, cupping, checks, bows, cracks, and other imperfections that would produce objectionable defects in finished work.
2. Depth of forms to be same depth as concrete being placed.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: Grade 60 steel conforming to AS A615 and free of rust, dirt, grease or oils.

B. Steel Tie Wire: 16-gauge plain cold-drawn steel conforming to AS A1064/A1064M and free of rust, dirt, grease or oils.

C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified.

D. Steel Bar Mats:
1. Grade 60 deformed steel bars assembled with clips conforming to AS A184 and free of rust, dirt, grease or oils.

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
1. Portland Cement: ASTM C 150, gray portland cement Type III or Type V. Supplement with the following:
   a. Fly Ash: ASTM C 618, Class C or F. Fly Ash content not to exceed 25% total concrete weight.
   b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33, Class 4S uniformly graded. Provide aggregates from a single source.
1. Maximum Aggregate Size: 1 inch (25 mm) nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: Potable and complying with ASTM C 94/C 94M.

D. Air-Entraining Admixture: ASTM C 260.

E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain no more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
3. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.

F. Liquid Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Davis Colors.
   b. Admixtures Inc.
   c. Scofield, L. M. Company.
   d. Solomon Colors, Inc.

2.5 CURING AND SEALING MATERIALS

A. Amber, Aliphatic, Membrane-Forming Curing and Sealing Compound; manufactured for use with colored concrete.
1. Admixtures Inc; Colorfull Clear Curing Compound.
2. 1100-Clear by WR Meadows; www.wrmeadows.com.

2.6 RELATED MATERIALS

A. Fine and Coarse Aggregate: Clean, hard, and durable washed concrete sand conforming to ASTM C33. Use same fine aggregate from single source throughout duration of Project. Refer to Paving Schedule on Drawings for sizing of coarse aggregate. Some paving types may require different coarse aggregate sizes

B. Joint Fillers: ASTM D 5249, Type 2, flexible foam expansion joint in preformed strips.
   1. Products: W.R. Meadows; Seal Tight Cermar.

C. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch (3 to 6 mm).
   1. ACC; Optimus.
   2. Grace, Topcast.

2.7 JOINT MATERIALS

A. Construction Joints:
   1. Steel Slip Dowels: 5/8-inch-diameter smooth steel bars, free of dirt, grease, and oils.
   2. Plastic Dowel Sleeves: Encase 50 percent of each dowel in a Speed Dowel® plastic alignment sleeve to allow parallel lateral movement of each dowel.
      a. Acceptable Manufacturers:
         1) Speed Dowel® by Greenstreak Group; www.greenstreak.com.

2.8 CONCRETE SEALER

A. Low sheen, low VOC, penetrating sealer that exhibits superior resistance to stains, spills, and other contaminates.

B. Acceptable Manufacturers:
   1. Repello® by Scofield; www.scofield.com.
   2. Siloxene PD® by Prosoco; www.prosoco.com.
   3. 511 Impregnator by Miracle Sealants; www.miraclesealants.com.

PART 3 - EXECUTION

3.1 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301 (ACI 301M), for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
   1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.

B. Proportion mixtures to provide normal-weight concrete with the following properties:
   1. Compressive Strength (28 Days): 2800 psi.
   2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.50.
   3. Slump Limit: 5 inches (125 mm). plus or minus 1 inch (25 mm).

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content: 5 percent plus or minus 1.5 percent for 3/4-inch (19-mm) nominal maximum aggregate size.

D. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use water-reducing and retarding admixture in concrete as required for placement and workability.

E. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd. (0.60 kg/cu. M)

F. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

3.2 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.
   1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

3.3 SUBGRADE

A. Subgrade to meet requirements of project’s Geotechnical report.

B. Water condition subgrade and compact to 90 percent relative compaction is placed over prior to placing concrete.
   1. Screed subgrade to a smooth plane.
   2. Ensure that utilities, including irrigation lines are buried and compacted.
   3. Keep subgrade damp prior to placing concrete.

3.4 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below decorative concrete work to identify soft pockets and areas of excess yielding.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.5 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

B. Protect adjacent construction from discoloration and spillage during application of color hardeners, release agents, stains, curing compounds, and sealers.

3.6 FORMWORK

A. General:
   1. Construct forms accurately to dimensions, plumb and true to line and grade.

2. Use forms that are strong, mortar tight, braced and tied so as to maintain position and shape during placing of reinforcing and concrete.
3. Wavy surfaces and bulged walls or slab surfaces resulting from settlement or springing of formwork will be rejected.
4. Carefully verify and check forms for alignment and level as the Work proceeds.
5. Make needed adjustments or add additional bracing prior to pouring concrete.

B. Formwork Material at Exposed Surfaces: Smooth metal, resin-coated plywood, or high-density overlay plywood which will provide an ultra-smooth surface.

C. Tolerances for Exposed Concrete:
1. Top of form units shall not vary more than 1/8 inch from a 10 feet long straight edge.
2. Vertical faces shall not vary more than 1/8 inch from a 10 feet long straight edge.

D. Joints:
1. Construct forms and assemble them in such a manner so that joints occur at accepted locations.
2. Seal joints to prevent leakage and provide exposed finish surfaces free of joint marks or any indication of where the form joints occurred.

E. Corners:
1. Form intersecting planes to provide true, clean-cut corners, with edge grain of plywood not exposed to face of concrete.
2. Form exposed corners to produce square smooth, solid unbroken lines, unless indicated otherwise.

F. Other Trade Requirements:
1. Construct chases, slots and recesses as required.
2. Locate inserts, anchor plates and other items to be embedded in concrete where required, properly place and securely anchor.

G. Recesses and Openings: Provide as shown on the Drawings.

H. Prior to Pouring Concrete:
1. Thoroughly clean out forms to be used.
2. Thoroughly wet wood forms where form coatings are not used.

I. Removal of Forms:
1. Do not remove supporting forms or shoring until concrete has sufficient strength to carry its own weight and other loads upon it.
2. Remove forms only after concrete has attained at least 50% of its design compressive strength.

J. Re-use of Forms:
1. Do not reuse if there is any evidence of surface wear or tear which would impair quality of exposed finishes.
2. Store formwork and form materials in such a manner as to prevent damage or distortion.
3. Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage to concrete finish.

3.7 REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch (50-mm) overlap to adjacent mats.

3.8 FORM TIES

A. Exposed form ties will not be visible once the concrete wall is architecturally finished, however, form ties will still be required to construct wall.

B. Internally disconnecting or removable ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete upon removal. Furnish internally disconnecting ties that will leave no metal closer than 1-1/2-inches from the architectural concrete surface.

C. Form ties to have a minimum working strength when fully assembled of at least 3,000 lbs.

D. Adjust form ties in length so as to permit complete tightening of forms and of such type as to lean no metal closer than 1-inch to an exterior surface or closer than ½-inch to an interior surface.

E. Do not fit form ties with lugs, cones, washers, or other device so as to act as a spreader within forms, or for other purposes that will leave a hole or depression larger than 7/8-inch in diameter back of exposed surface of concrete.

F. Do not use wire or wood ties.

G. Coat ties that are to be pulled from walls with cup grease or other approved material to facilitate efficient removal.

H. Loosen tie rods that are to be entirely removed from walls 24 hours after concrete is poured. Remove all but a sufficient number of ties to hold forms in place.

3.9 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
   1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
   1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
   2. Dowelled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

C. Expansion Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
   1. Locate expansion as indicated.
   2. Extend joint fillers full width and depth of joint.
   3. Terminate joint filler not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished surface if joint sealant is indicated.
   4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
   5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
   6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 3/16-inch- (5-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
   1. Perform jointing with a new diamond tip circular saw.
   2. Joint Width: Per Drawings. Do not exceed 3/16-inch in width.
   3. Depth of sawcuts: 1/4th depth of slab.
   4. Sawcut joints in a straight line complete with no overcutting.
   5. Use a hand tool to sawcut up to vertical edges such as walls, steps, curbs and columns. No over cutting into vertical surfaces will be allowed.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch (6-mm) radius. Repeat tooling of edges after applying surface finishes. Eliminate edging tool marks on concrete surfaces.

3.10 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

B. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

C. Comply with ACI 301 (ACI 301M) requirements for measuring, mixing, transporting, and placing concrete.

D. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

E. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

F. Consolidate concrete according to ACI 301 (ACI 301M) by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
   1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement dowels and joint devices.

G. Screed paving surface with a straightedge and strike off.

H. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

I. Hot-Weather Placement: Comply with ACI 301 (ACI 301M)and as follows when hot-weather conditions exist:
   1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
   2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.11 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

C. Broom Finish:
   1. Prior to brooming, provide a floated finish.
   2. While the surface is still plastic, provide a uniform, broom-texture finish by pulling a fiber-bristle broom uniformly over the surface.
   3. Broom sidewalk paving along street in direction 90 degrees to street curb.
   4. Broom Service Area paving in direction 90 degrees to building walls.
   5. Provide texture to match the accepted mock-up finish.

3.12 RETARDANT CONCRETE FINISH

A. Concrete Finish; after final floating:
   1. Retardant Finish: Roll with roller tamper and then immediately bullfloat in both directions. Immediately after initial floating, towel smooth with no indentions, apply retardant when surface has sufficient moisture in the surface.
   2. Spray-apply chemical surface retarder to paving according to manufacturer's written instructions.
   3. Provide texture to match the accepted mock-up finish.

3.13 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Begin curing after finishing concrete but not before and applying retardant finish.

C. Curing and Sealing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.14 TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:
   1. Elevation: 3/4 inch (19 mm).
   2. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
   3. Surface: Gap below 10-foot- (3-m-) long, unleveled straightedge not to exceed 1/8 inch (3 mm).
   4. Lateral Alignment and Spacing of Dowels: 1 inch (25 mm).
   5. Vertical Alignment of Dowels: 1/4 inch (6 mm).
   6. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches (6 mm per 300 mm) of dowel.
   7. Joint Spacing: 1/8 inches (3 mm).
   8. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
   9. Joint Width: 1/16 inches (1.5 mm).

3.15 FIELD QUALITY CONTROL

A. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).

B. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

C. Decorative concrete paving will be considered defective if it does not pass tests and inspections.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.16 STAINING AND SEALING

A. Allow Stratified or Sedimentary ™ to dry sufficiently before applying specified stain or sealer.

B. Do not apply sealer if air temperatures are below 50 degree F or above 90 degrees F.

C. Once the concrete surface has been sealed, protect surface until fully dried.

D. Follow manufacturer’s directions for stain or sealer application.

3.17 REPAIRS AND PROTECTION

A. Remove and replace decorative concrete paving that is broken or damaged or does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Protect decorative concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

C. Maintain decorative concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 13 16

This page intentionally left blank.

SECTION 32 15 31 – DECOMPOSED GRANITE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section includes decomposed granite, and the following:
   1. Sub-grade Preparation
   2. Base Preparation
   3. Stabilizer Application
   4. Compaction
   5. Cleanup

B. Related work:
   1. Section 32 91 19: Finish Grading
   2. Section 32 90 00: Landscape Planting

C. Definitions: The word Architect as used herein shall refer to the Landscape Architect or the Owner's authorized representative.

1.2 SUBMITTALS:

A. Procedure: In accordance with Division One, or two weeks prior to start of installation.

B. Submit one pint sample of the specified decomposed granite, with named source.

C. Submit product information and data for Soil Stabilizer.

PART 2 - PRODUCTS

2.1 DECOMPOSED GRANITE:

A. Decomposed granite is referred to by the abbreviation (D.G.), or referred to as disintegrated granite. All decomposed granite for vehicular surfaces shall conform to the following grading requirements:

Sieve Designation	% Passing
3/8 inch	100
No. 4	95-100
No. 8	75-80
No. 16	55-65

Sieve Designation	% Passing
No. 30	40-50
No. 50	25-35
No. 100	20-25
No. 200	5-15

B. The portion of D.G retained on the no. 4 sieve shall have a maximum percentage of wear of 50 at 500 revolutions as determined by AASHTO T96.

C. The portion passing a No. 40 sieve shall have a maximum liquid limit of 25 and maximum plasticity index of 7 as determined by AASHTO T89 and AASHTO T90, respectively.

D. D.G. to be used for pathways and non-vehicular areas may be ¼" minus sieve size.

E. Crushed aggregate screenings shall be free from clay lumps, vegetative matter and deleterious material.

F. See Drawings for D.G. color specification.

2.2 SOIL STABILIZER:

A. Stabilizer shall be a non-toxic, colorless, odorless, organic powder that binds D.G. screenings. The stabilizer shall be as manufactured by Stabilizer Solutions Inc., (800) 336-2468, FAX: (602) 852-0718.

2.3 EDGING

A. Steel edging: 3/16" x 5 ½". Stakes 12" long, lock 1/2" below top of edging.
   1. Finish: Black anodized

PART 3 - EXECUTION

3.1 SUBGRADE AND DECOMPOSED GRANITE PREPARATION AND COMPACTION

A. Subgrade and base under all D.G. shall be prepared and compacted to 90% relative compaction.

B. Minimum compaction for D.G. surfaces shall be 90% relative compaction.

C. The finish grade shall be even between the headers with no humps or depressions after the compaction. The Contractor shall provide compaction tests as required by the Architect.

D. Treat compacted subgrade with pre-emergent herbicide, as recommended by certified pest control advisor.

3.2 SOIL STABILIZER AND DECOMPOSED GRANITE INSTALLATION

A. Soil stabilizer shall be thoroughly blended with the D.G. screenings prior to installation.
   1. The stabilizer shall be mixed at a rate of 12 Lbs. of Stabilizer product per ton of D.G. screenings.
   2. Mixed stabilizer product in accordance with its manufacturer's instruction.
   3. Premixed Stabilizer and D.G. material can be obtained locally by contacting the stabilizer manufacturer and obtaining the location of a local vendor.
   4. Not acceptable: drop spreading of the Stabilizer product over raked D.G. screenings and mixing stabilizer by rototilling.

B. Place the premixed stabilizer product on the desired subgrade in maximum 2" lifts. Rake smooth to the desired grade and cross slope.

C. After placement and raking, water the Stabilized D.G. to achieve full depth moisture penetration of the placed product. A one-hour rate of 20 gpm per 1,000 sq. ft. should achieve the proper full depth moisture penetration.

D. While the Stabilized D.G. is still thoroughly moist roll the material with a heavy lawn roller, approximately 1000 to 3000 pounds, and maximum 30" wide, to achieve finish grade and initial compaction. Utilize a hand tamp at edges, around benches, and sign posts. Do not use a wacker or vibratory roller to compact the Stabilized D.G.
   1. Compacted finish surface of DG is to be level with adjacent paving, unless otherwise indicated.

2. Compacted finish surface of DG is to be one-inch above finish grade in adjacent planting areas, unless otherwise indicated.

E. Allow the finished surface sufficient time to dry prior to use.

3.3 CLEANUP

A. After all stabilization operations are completed, remove trash, excess materials, empty containers and rubbish from the property. All scars, ruts or other marks in the ground caused by this work shall be repaired and the ground left in a smooth condition throughout the site.

END OF SECTION 32 15 30

This page intentionally left blank.

SECTION 321713 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.01 REFERENCE:

A. Related Sections:

1. Section 321216: Asphalt Paving.

1.02 DESCRIPTION:

A. Principal Work Items Are:

1. Painted lines, lettering, and symbols at parking areas.

2. Painted stripes at exterior stairs.

3. Fire Lane “No Parking.”

4. Curb marking and red curbs.

1.03 JOB CONDITIONS:

A. Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F for water-based materials, and not exceeding 95 deg F.

B. Sequencing, Scheduling: Coordinate with paving work. Verify that paint type is compatible with asphalt paving surfaces seal coats.

C. Protection: Do not apply pavement markings for seven days after application of asphalt surface seal coat. After application, protect from traffic until thoroughly dry.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Traffic Paint:

1. Type: Water base, roadway traffic lane marking type; colors as selected.

2. Acceptable Manufacturers:

a. Dunn-Edwards, Vin-L-Stripe No. W-801, vinyl-epoxy as a standard of quality.

b. J. E. Bauer latex base Formula No. 1030A9 White, No. 1056A9 Yellow, No. 1865A9 Blue, No. 1118A9 Green, and No. 1854A9 Red.

c. Sinclair No. 160 Vinyl Traffic Line Paint, water base.

d. Ennis Traffic Safety Solutions, product 6000 white & 6006 blue.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Layout: Accurately measure and layout work. Use stencils for all work; snap lines for straight work.

B. Prior to application of paint, allow the pavement to properly cure. Clean and prepare in accordance with paint manufacturer's written recommendations.

C. Provide mechanical equipment to install paint in a uniform, straight or curved pattern, without holidays and other defects.

D. Do not permit traffic until paint has completely cured.

E. Provide two installations/applications of pavement marking; once for initial use and once after final seal coat.

F. Install 2 coats in thickness recommended by manufacturer.

3.02 APPLICATION:

A. Painted Lines, Lettering, and Symbols At Parking Areas:

1. Parking Stall Lines: 4 inches wide, color white.

2. Access aisles for accessible parking spaces shall be marked by a blue painted borderline around their perimeter. The area within the blue borderlines shall be marked with hatched lines a maximum of 36” on center in a color contrasting with that of the aisle surface, preferably blue or white. Access aisle markings may extend beyond the minimum required length. CBC Section 11B-502.3.3.

3. Access aisles for passenger drop-off and loading zone shall be marked with a painted borderline around the perimeter. The area within the borderlines shall be marked with hatched lines a maximum of 36” on center in a color contrasting with that of the aisle surface. CBC section 11B-503.5.

4. Color: White, for all work except blue at wheelchair accessible parking stalls borders and red at Fire Lanes.

5. Specific areas designated as fire lanes must be marked with red curbs using OSHA safety red paint. “FIRE LANE – NO PARKING” shall be painted on the top of curb in 3” white lettering at a spacing of 30’ on center or portion thereof.

6. Painted lines and markings on pavement at wheelchair accessible parking stalls shall be 4 inches wide (blue in color) equal of Color No. 15090 per Federal Standard 595C.

7. Detectable warnings surfaces shall comply with CBC Section 11B-705.1.

8. Detectable warning surfaces shall be yellow conforming to FS 33538 of Federal Standard 595B, except for locations at curb ramps, islands, or cut-through medians where color used shall contract

visually with that of adjacent walking surfaces, either light-on-dark, or dark-on-light. CBC Sections 11B-705.1.1.3 and 11B-705.1.1.5.

9. Provide a minimum 5 year warranty on detectable warning surfaces per DSA Bulletin 10/31/02, revised 04/09/08.

B. Stripes At Exterior Stairs:

1. Stripes: 2" wide, located 2" from, and parallel to, nosing.

2. Required Locations: All treads, all top landings, all intermediate landings.

END OF SECTION 321713

This page intentionally left blank.

SECTION 321726 - TACTILE WARNING SURFACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cast-in-place detectable warning tiles.
2. Surface-applied detectable warning tiles.

B. Related Requirements:

1. Section 321313 "Cement Concrete Pavment" for concrete walkways serving as substrates for tactile warning surfacing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Manufacturer's storage and handling requirements and recommendations.
2. Manufacturer's preparation instructions and recommendations.
3. Manufacturer's installation instructions and recommendations.

B. Shop Drawings: Provide shop drawings showing installation details and tactile warning surfacing layout.

1. If expansion and control joints are not shown on Drawings, show expansion and control joints in accordance with manufacturer's instructions and recommendations on shop drawings.
2. Show sound amplification on cane contact feature.

C. Samples for Verification: For each type and color of tactile warning surface, in manufacturer's standard sizes, not less than 6 inches (150 mm) square, showing edge condition, truncated-dome pattern, texture, color, and cross section; with fasteners and anchors.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and manufacturer.

B. Certificates: Provide written documentation, signed by an authorized representative of tactile warning surfacing that tactile warning surfacing is DSA-AC approved detectable warning and detectable directional texture.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for tactile warning surfacing.

1. All tests shall be current within a 24 month period.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For tactile warning surfacing, to include in maintenance manuals.

1. Include tactile warning surfacing manufacturer's maintenance manual for complete care of tactile warning surfacing.
2. Include recommendations for cleaning and stain removal methods, and cleaning materials.
3. Include tactile warning surfacing manufacturer's and supplier's name, address, and telephone number.
4. Include the product name, serial or model number, and color for each tactile warning surface tile product.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer certified in writing by tactile warning surfacing manufacturer as qualified for installation, who has successfully completed installations similar in material, design, and extent to that indicated for Project.

B. Manufacturer Qualifications: Company specializing in manufacture of tactile warning surfacing with not less than five years documented experience.

C. Mockups: Build mockups of each type of tactile warning surfacing to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockup of each type of tactile warning surfacing area as shown on Drawings.

a. Architect will select one tactile warning surfacing area of each type to represent surfaces and conditions for installation of tactile warning surfacing.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review Contract Documents, manufacturer's drawings, and manufacturer's installation instructions and recommendations and refer any and all discrepancies to the Architect.

1.8 DELIVERY, STORAGE AND HANDLING

A. Tactile warning surfacing shall be suitably packaged or crated to prevent damage in shipment or handling. Finished surfaces shall be protected by sturdy plastic wrappings to protect them from concrete residue during installation.

1. Handle detectable warning tiles with temporary protective coating on finished surfaces to prevent coated surfaces from contacting backs or edges of other units.

B. Tactile warning surfacing type shall be identified by part number.

C. Tactile warning surfacing shall be delivered to location at building site for storage prior to installation.

1.9 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

B. Weather Limitations for Adhesive Application:

1. Apply adhesive only when ambient temperature is above 50 deg F (10 deg C) and when temperature has not been below 35 deg F (2 deg C) for 12 hours immediately before application. Do not apply when substrate is wet or contains excess moisture.

C. The use of water for work, cleaning or dust control, etc. shall be contained and controlled and shall not be allowed to come into contact with the general public. Provide barricades or screens to protect the general public.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of tactile warning surfaces that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering and wear.
b. Separation or delamination of materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of tactile warning surfacing, joint material, adhesive, anchor, and fastener from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

2.2 ACCESSIBILITY REQUIREMENTS

A. Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.

B. Detectable Warnings (Tactile Warning Surfacing) and Detectable Directional Texture:

1. Detectable Warnings (Tactile Warning Surfacing):

a. General: Detectable warnings (tactile warning surfacing) shall be provided in accordance with CBC Section 11B-247.1 and shall comply with CBC Section 11B-705.1 per CBC Section 11B-247.1.1.

b. Where Required: Detectable warnings (tactile warning surfacing) shall be provided where required by CBC Section 11B-247.1.2 per CBC Section 11B-247.1.2.

1) Platform Edges: Platform boarding edges shall have detectable warnings (tactile warning surfacing) complying with CBC Sections 11B-705.1.1 and 11B-705.1.2.1 per CBC Section 11B-247.1.2.1.

2) Curb Ramps: Curb ramps shall have detectable warnings (tactile warning surfacing) complying with CBC Sections 11B-705.1.1 and 11B-705.1.2.2 per CBC Section 11B-247.1.2.2.

3) Islands or Cut-Through Medians: Islands or cut-through medians shall have detectable warnings (tactile warning surfacing) complying with CBC Sections 11B-705.1.1 and 11B-705.1.2.3 per CBC Section 11B-247.1.2.3.

4) Bus Stops: Where detectable warnings (tactile warning surfacing) are provided at bus stop boarding and alighting areas in compliance with CBC Section 11B-810.2.3, detectable warnings (tactile warning surfacing) shall comply with CBC Sections 11B-705.1.1 and 11B-705.1.2.4 per CBC Section 11B-247.1.2.4.

5) Hazardous Vehicular Areas: If a walk crosses or adjoins a vehicular way, and the walking surfaces are not separated by curbs, railings, or other elements between the pedestrian areas and vehicular areas, the boundary between the areas shall be defined by a continuous detectable warning (tactile warning surfacing) complying with CBC Sections 11B-705.1.1 and 11B-705.1.2.5 per CBC Section 11B-247.1.2.5.

6) Reflecting Pools: The edges of reflecting pools shall be protected by railings, walls, warning curbs, or detectable warnings (tactile warning surfacing) complying with CBC Sections 11B-705.1.1 and 11B-705.1.2.6 per CBC Section 11B-247.1.2.6.

7) Track Crossings: Where it is necessary to cross tracks to reach transit boarding platforms, detectable warnings (tactile warning surfacing) complying with CBC Sections 11B-705.1.1 and 11B-705.1.2.7 per CBC Section 11B-247.1.2.7.

2. Detectable Directional Texture: At transit boarding platforms, the pedestrian access shall be identified with a detectable directional texture complying with CBC Section 11B-705.2 per CBC Section 11B-247.2.

C. Floor or Ground Surfaces:

1. General: Floor and ground surfaces shall be stable, firm, and slip resistant and shall comply with CBC Section 11B-302 per CBC Section 11B-302.1.

a. Exceptions:

1) Within animal containment areas, floor and ground surfaces shall not be required to be stable, firm, and slip resistant.

2) Areas of sport activity shall not be required to comply with CBC Section 11B-302.

D. Detectable Warnings (Tactile Warning Surfacing) and Detectable Directional Texture:

1. Detectable Warnings (Tactile Warning Surfacing):

a. General: Detectable warnings (tactile warning surfacing) shall consist of a surface of truncated domes and shall comply CBC Section 11B-705 and CBC Figure 11B-705.1 per CBC Section 11B-705.1.1.

1) Dome Size: Truncated domes in a detectable warning surface (tactile warning surfacing) shall have a base diameter of 0.9 inch (22.9 mm) minimum and 0.92 inch (23.4 mm) maximum, a top diameter of 0.45 inch (11.4 mm) minimum and 0.47 inch (11.9 mm) maximum, and a height of 0.2 inch (5.1 mm) per CBC Section 11B-705.1.1.1.

2) Dome Spacing: Truncated domes in a detectable warning surface (tactile warning surfacing) shall have a center-to-center spacing of 2.3 inches (58 mm) minimum and 2.4 inches (61 mm) maximum, and a base-to-base spacing of 0.65 inch (16.5 mm) minimum, measured between the most adjacent domes on a square grid per CBC Section 11B-705.1.1.2.

a) Exception: Where installed in a radial pattern, truncated domes shall have a center-to-center spacing of 1.6 inches (41 mm) minimum to 2.4 inches (61 mm) maximum.

3) Color and Contrast: Detectable warning surfaces (tactile warning surfacing) at transit boarding platforms edges, bus stops, hazardous vehicular areas, reflecting pools, and track crossings shall comply with CBC Section 11B-705.1.1.3.1. Detectable warnings at other locations shall comply with either CBC Section 11B-705.1.1.3.1 or CBC Section 11B-705.1.1.3.2. The material used to provide visual contrast shall be an integral part of the surface per CBC Section 11B-705.1.1.3.

a) Detectable warning surfaces (tactile warning surfacing) shall be yellow and approximate FS 33538 of Federal Standard 595C per CBC Section 11B-705.1.1.3.1.

b) Detectable warning surfaces (tactile warning surfacing) shall provide a 70 percent minimum visual contrast with adjacent walking surfaces per CBC Section 11B-705.1.1.3.2. Contrast in percent shall be determined by:

1. Contrast percent equals [(B1-B2)/B1] x 100.
2. B1: Light reflectance value (LRV) of the lighter area.
3. B2: Light reflectance value (LRV) of the darker area.
4. Exception: Where the detectable warning surface (tactile warning surfacing) does not provide a 70 percent minimum contrast with the adjacent walking surfaces, a 1 inch (25 mm) wide minimum visually contrasting surface shall separate the detectable warning (tactile warning surfacing) from adjacent walking surfaces. The visually contrasting surface shall contrast with both the detectable warning (tactile warning surfacing) and adjacent walking surfaces either light-on-dark or dark-on-light.

4) Resiliency: Detectable warning surfaces (tactile warning surfacing) shall differ from adjoining surfaces in resiliency or sound-on-cane contact per CBC Section 11B-705.1.1.4.

a) Exception: Detectable warning surfaces at curb ramps, islands, or cut-through medians shall not be required to comply with CBC Section 11B-705.1.1.4.

b. Locations: Detectable warnings (tactile warning surfacing) at the following locations shall comply with CBC Section 11B-705.1 per CBC Section 11B-705.1.2.

1) Platform Edges: Detectable warning surfaces (tactile warning surfacing) at platform boarding edges shall be 24 inches (610 mm) wide and shall extend the full length of the public use areas of the platform per CBC Section 11B-705.1.2.1.

2) Curb Ramps: Detectable warnings (tactile warning surfacing) at curb ramps shall extend 36 inches (914 mm) in the direction of travel. Detectable warnings (tactile warning surfacing) shall extend the full width of the ramp run less 2 inches (51 mm) maximum on each side, excluding any flared sides. Detectable warnings (tactile warning surfacing) shall be located so the edge nearest the curb is 6 inches (152 mm) minimum and 8 inches (203 mm) maximum from the line at the face of the curb marking the transition between the curb and the gutter, street, or highway per CBC Section 11B-705.1.2.2.

a) Exception: On parallel curb ramps, detectable warnings (tactile warning surfacing) shall be placed on the turning space at the flush transition between the street and sidewalk. Detectable warnings (tactile warning surfacing) shall extend the full width of the turning space at the flush transition between the street and sidewalk less 2 inches (51 mm) maximum on each side.

3) Islands or Cut-Through Medians: Detectable warnings (tactile warning surfacing) at pedestrian islands or cut-through medians shall be 36 inches (914 mm) minimum in depth extending the full width of the pedestrian path or cut-through less 2 inches (51 mm) maximum on each side, placed at the edges of the pedestrian island or cut-through median, and shall be separated by 24 inches (610 mm) minimum of walking surface without detectable warnings per CBC Section 11B-705.1.2.3.

a) Exception: Detectable warnings (tactile warning surfacing) shall be 24 inches (610 mm) minimum in depth at pedestrian islands or cut-through medians that are less than 96 inches (2438 mm) in length in the direction of pedestrian travel.

4) Bus Stops: When detectable warnings (tactile warning surfacing) are provided at bus stop boarding and alighting areas, the detectable warnings (tactile warning surfacing) shall extend the full width of the boarding/alighting area and shall be 36 inches (914 mm) in depth per CBC Section 11B-705.1.2.4.

5) Hazardous Vehicular Areas: Detectable warnings (tactile warning surfacing) at hazardous vehicular areas shall be 36 inches (914 mm) in width per CBC Section 11B-705.1.2.5.

6) Reflecting Pools: When detectable warnings (tactile warning surfacing) are provided at reflecting pools, it shall be 24 inches (610 mm) minimum and 36 inches (914 mm) maximum in width per CBC Section 11B-705.1.2.6.

7) Track Crossings: Detectable warnings (tactile warning surfacing) at track crossings shall be 36 inches (914 mm) in the direction of pedestrian travel and extend the full width of the circulation path per CBC Section 11B-705.1.2.7.

2. Detectable Directional Texture: Detectable directional texture (tactile warning surfacing) at transit boarding platforms shall comply with CBC Figure 11B-705.2 and shall be 0.1 inch (2.5 mm) in height that tapers off to 0.04 inch (1.0 mm), with bars raised 0.2 inch (5.1 mm) from the surface. The raised bars shall be 1.3 inches (33 mm) wide and 3 inches (76 mm) from center-to-center of each bar. This surface shall differ from adjoining walking surfaces in resilience or sound-on-cane contact. The color shall be yellow and approximate FS 33538 of Federal Standard 595C. This surface will be placed directly behind the yellow detectable warning texture (tactile warning surfacing) specified in CBC Section 11B-705.1.2.1, aligning with all doors of the transit vehicles where passengers will embark. The width of the directional texture (tactile warning surfacing) shall be equal to the width of the transit vehicle's door opening. The depth of the texture shall not be less than 36 inches (914 mm) per CBC Section 11B-705.2 and CBC Figure 11B-705.2.
3. Product Approval: Only approved DSA-AC detectable warning products (tactile warning surfacing) and directional surfaces (tactile warning surfacing) shall be installed as provided in the California Code of Regulations (CCR), Title 24, Part 1, Chapter 5, Articles 2, 3, and 4. Refer to CCR Title 24, Part 12, Chapter 11B, Section 12-11B.205 for building and facility access specifications for product approval for detectable warning products (tactile warning surfacing) and directional surfaces (tactile warning surfacing) per CBC Section 11B-705.3.

2.3 PERFORMANCE REQUIREMENTS

A. Water Absorption: Shall not exceed 0.05 percent when tested per ASTM D 570.

B. Slip Resistance: Combined wet and dry static coefficients of friction shall not be less than 0.80 on top of domes and field area when tested per ASTM C 1028.

C. Compressive Strength: Shall not be less than 28,000 psi when tested per ASTM D 695.

D. Tensile Strength: Shall not be less than 19,000 psi when tested per ASTM D 638.

E. Flexural Strength: Shall not be less than 25,000 psi when tested per ASTM D 790.

F. Chemical Stain Resistance: Shall withstand the following without discoloration or staining when tested per ASTM D 543:

1. 10 percent hydrochloric acid.
2. Urine.
3. Saturated calcium chloride.
4. Black stamp pad ink.
5. Chewing gum.
6. Red aerosol paint.
7. 10 percent ammonium hydroxide.
8. 1 percent soap solution.
9. Turpentine.
10. 5 percent urea.
11. Diesel fuel.
12. Motor oil.

G. Abrasive Wear: Average wear depth shall not exceed 0.060 inches (1.524 mm) after 1000 abrasion cycles when measured on the top surface of the dome representing the average of three measurement locations per sample.

1. When tested with BYK - Gardner Tester per ASTM D 2486 with reciprocating linear motion of plus or minus 37 cycles per minute over a 10 inch (254 mm) travel.
2. The abrasive medium, 40 grit Norton Metallite sand paper, shall be fixed and leveled to a holder.
3. The combined mass of the sled, weight and wood block shall be 3.2 lb (1.45 kg).

H. Resistance to Wear: Shall not be less than 500 when tested per ASTM C 501.

I. Impact Resistance: Shall have a mean failure energy expressed as a function of specimen thickness of not less than 550 in. lbf/in when tested per ASTM D 5420, Geometry "GE".

1. A failure is noted when a crack is visible on either surface or when any brittle splitting is observed on the bottom plaque in the specimen.

J. Accelerated Weathering: Shall exhibit the following result, delta E less than 4.5, as well as no deterioration, fading or chalking of yellow, conforming to Federal Color No. 33538, surface when tested per ASTM G 155 for 3000 hours.

K. Accelerated Aging and Freeze Thaw Test: Shall show no evidence of cracking, delamination, warpage, checking, blistering, color change, loosening, or other detrimental defects when tested per ASTM D 1037.

L. Salt and Spray Performance: Shall not show any deterioration or other defects after 200 hours of exposure when tested per ASTM B 117.

M. The detectable warning tiles shall exhibit no visible damage at the maximum load of 10,400 lbs (4,717.36 kg) when tested per AASHTO HB-17 single wheel HS20-44 loading "Standard Specifications for Highways and Bridges."

1. The cast-in-place tactile warning surfacing shall be mounted on a concrete platform with a 1/2 inch (12.7 mm) airspace at the underside of the cast-in-place tactile warning surfacing.
2. The cast-in-place tactile warning surfacing shall be subjected to the specified maximum load of 10,400 lbs (4,717.36 kg), corresponding to an 8000 lb (3628.74 kg) individual wheel load and a 30 percent impact factor.

2.4 SUSTAINABILITY REQUIREMENTS

A. Comply with applicable provisions in the CGBC.

B. Sealants: Use products that comply with CGBC Section 5.504.4.1.

1. Sealants and sealant primers shall comply with maximum VOC limits listed in CGBC Table 5.504.4.2.

C. VOC Content: Sealants and sealant primers shall comply with the following:

1. Sealants shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Sealant primers for porous substrates shall have a VOC content of 775 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Low-Emitting Sealants: Sealants and sealant primers shall comply with the requirements of authorities having jurisdiction.

2.5 TACTILE WARNING SURFACING, GENERAL

A. For tactile warning surfaces composed of multiple units, provide units that when installed provide consistent side-to-side and end-to-end dome spacing that complies with requirements.

2.6 DETECTABLE WARNING TILES

A. Cast-in-Place Detectable Warning Tiles: Accessible truncated-dome detectable warning tiles configured for setting flush in new concrete walkway surfaces, with slip-resistant surface treatment on domes and field of detectable warning tiles.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Engineered Plastics Inc.; Armor-Tile; Vitrified Polymer Composite (VPC) Cast In Place Detectable/Tactile Warning Surface Tile, or a comparable product by one of the following:

    a. Access Products, Inc.
    b. ADA Solutions, Inc.
    c. AlertTile; a division of Cape Fear Systems, II, LLC.
    d. Arcis Corp.
    e. Armorcast Products Company.
    f. Transpo Industries, Inc.

2. Material: Vitrified Polymer Composite (VPC), an epoxy polymer composition with an ultra violet stabilized coating employing aluminum oxide particles in the truncated domes.

    a. Detectable warning tiles shall incorporate an in-line pattern of truncated domes 0.20 inch (5.08 mm) high, with 0.90 inch (22.86 mm) base diameter, and 0.45 inch (11.43 mm) top diameter, spaced center-to-center not less than 2.35 inches (59.69 mm) and not more than 2.40 inches (60.96 mm) as measured "in line."
    b. The field area shall consist of a non-slip surface with not less than 40 - 90 degree raised points, 0.045 inch (11.43 mm) high, per square inch.

3. Color: Yellow conforming to Federal Color No. 33538. Color shall be homogeneous throughout the detectable warning tile.

    a. Color at curb ramps, islands, and cut-through medians as indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

4. Shapes and Sizes:

    a. Rectangular Panels:

        1) Length: As indicated on Drawings.
        2) Width: As indicated on Drawings.
        3) Depth: 1.375 inches (34.925 mm) plus or minus 5 percent maximum.
        4) Face Thickness: 0.1875 inch (4.7625 mm) plus or minus 5 percent maximum.
        5) Warpage of Edge: 0.5 percent maximum.

6) Embedment Flange Spacing: Not more than 3.1 inches (78.74 mm) center-to-center.

5. Dome Spacing and Configuration: Truncated domes in detectable warning tiles shall have a center-to-center spacing of not less than 2.3 inches (58 mm) and not more than 2.4 inches (61 mm), and a base-to-base spacing of not less than 0.65 inch (16.5 mm), measured between the most adjacent domes on a square grid.
6. Mounting:

a. Permanently embedded detectable warning tile wet-set into freshly poured concrete.

B. Surface-Applied Detectable Warning Tiles: Accessible truncated-dome detectable warning tiles configured for surface application on existing concrete walkway surfaces, with slip-resistant surface treatment on domes, field of detectable warning tiles, and beveled outside edges.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Engineered Plastics Inc.; Armor-Tile; Vitrified Polymer Composite (VPC) Surface Applied Detectable/Tactile Warning Surface Tile, or a comparable product by one of the following:

a. Access Products, Inc.
b. ADA Solutions, Inc.
c. AlertTile; a division of Cape Fear Systems, II, LLC.
d. Arcis Corp.
e. Armorcast Products Company.
f. Transpo Industries, Inc.

2. Material: Vitrified Polymer Composite (VPC), an epoxy polymer composition with an ultra violet stabilized coating employing aluminum oxide particles in the truncated domes.

a. Detectable warning tiles shall incorporate an in-line pattern of truncated domes 0.20 inch (5.08 mm) high, with 0.90 inch (22.86 mm) base diameter, and 0.45 inch (11.43 mm) top diameter, spaced center-to-center not less than 2.35 inches (59.69 mm) and not more than 2.40 inches (60.96 mm) as measured "in line."
b. The field area shall consist of a non-slip surface with not less than 40 - 90 degree raised points, 0.045 inch (11.43 mm) high, per square inch.

3. Color: Yellow conforming to Federal Color No. 33538. Color shall be homogeneous throughout the detectable warning tile.

a. Color at curb ramps, islands, and cut-through medians as indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

4. Shapes and Sizes:

a. Rectangular Panels:

1) Length: As indicated on Drawings.
2) Width: As indicated on Drawings.
3) Depth: 0.1875 inches (4.7625 mm) plus or minus 5 percent maximum.
4) Face Thickness: 0.1875 inch (4.7625 mm) plus or minus 5 percent maximum.
5) Warpage of Edge: 0.5 percent maximum.

5. Dome Spacing and Configuration: Truncated domes in detectable warning tiles shall have a center-to-center spacing of not less than 2.3 inches (58 mm) and not more than 2.4 inches (61 mm), and a base-to-base spacing of not less than 0.65 inch (16.5 mm), measured between the most adjacent domes on a square grid.
6. Mounting: Adhered and fastened to existing concrete walkway.

2.7 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of tactile warning surfacing, noncorrosive and compatible with each material joined, and complying with the following:

1. Furnish Type 304 stainless-steel fasteners for exterior use.
2. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant heads, colored to match tactile warning surfacing.

B. Adhesive: As recommended by manufacturer for adhering tactile warning surfacing to pavement.

C. Sealant: As recommended by manufacturer for sealing perimeter of tactile warning surfacing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions. Verify that installation of tactile warning surfacing will comply with accessibility requirements upon completion.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect surrounding work from damage and disfiguration.

B. Clean existing surfaces thoroughly prior to installation.

C. Prepare existing surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION OF TACTILE WARNING SURFACING

A. General: Prepare substrate and install tactile warning surfacing according to manufacturer's written instructions unless otherwise indicated.

B. Lay tactile warning surfacing in locations and pattern indicated on Drawings or as directed by Architect.

C. Lay tactile warning surfacing in accordance with manufacturer’s instructions and approved shop drawings.

D. Provide expansion and control joints where shown on Drawings.

1. If expansion and control joints are not shown on Drawings, provide expansion and control joints in accordance with manufacturer's instructions and approved shop drawings.

E. Place tactile warning surfacing units in dimensions and orientation indicated. Comply with location requirements of AASHTO MP 12.

3.4 INSTALLATION OF DETECTABLE WARNING TILES

A. Cast-in-Place Detectable Warning Tiles:

1. Concrete Paving Installation: Comply with installation requirements in Section 321313 "Cement Concrete Pavement." Mix, place, and finish concrete to conditions complying with detectable warning tile manufacturer's written requirements for satisfactory embedment of tile.
2. The physical characteristics of the concrete shall be consistent with the Contract Documents while maintaining a slump range of 4 - 7 to permit solid placement of the detectable warning tiles.

    a. An overly wet mix will cause the detectable warning tiles to float.
    b. Under these conditions, suitable weights such as two concrete blocks or 25 lb (11.34 kg) sandbags shall be placed on each detectable warning tile.

3. The factory-installed plastic sheeting must remain in place during the entire installation process to prevent the splashing of concrete onto the finished surface of the detectable warning tiles.
4. When preparing to set detectable warning tiles, it is important that no concrete be removed in the area to accept the detectable warning tiles.

    a. It is imperative that the installation technique eliminates any air voids under the detectable warning tiles.
    b. Holes in the detectable warning tile perimeter allow air to escape during the installation process.
    c. Concrete will flow through the large holes in each embedment flange on the underside of the detectable warning tiles.
    d. This will lock the detectable warning tiles solidly into the cured concrete.

5. Place concrete and finish true and smooth to the required dimensions and slope prior to the detectable warning tile placement.

    a. Immediately after finishing concrete, an electronic level should be used to check that the required slope has been achieved.
    b. Detectable warning tiles shall be placed true and square to the curb edge in accordance with the Contract Documents.

6. Detectable warning tiles shall be tamped (or vibrated) into the fresh concrete to ensure that the field level of the detectable warning tiles is flush to the adjacent concrete surface.

    a. The embedment process should not be accomplished by stepping on the detectable warning tiles as this may cause uneven setting which can result in air voids under the detectable warning tiles.
    b. Detectable warning tile field level (base of truncated domes) shall be flush with adjacent surfaces to permit proper water drainage and eliminate tripping hazards between adjacent finishes.

7. Immediately after placement, detectable warning tile elevation shall be checked relative to adjacent concrete.

    a. The elevation and slope of detectable warning tiles shall be set consistent with adjacent surfaces to permit water drainage to curb as indicated on the Drawings.
    b. Ensure that the field surface of detectable warning tiles is flush with the adjacent surfaces and back of curb so that no ponding is possible on the detectable warning tiles at the back side of curb.

8. While concrete is workable, finish the concrete edge around the detectable warning tile perimeter using a 3/8 inch (9.53 mm) radius edging tool, finish the concrete around the detectable warning tile perimeter with a steel trowel, flush with the field level of the detectable warning tile.

    a. Apply a broom-finish to the concrete in accordance with Section 32 13 13 "Cement Concrete Pavement" unless indicated otherwise.

9. It is imperative that there is no walking, leaning or external forces placed on the detectable warning tiles that may rock the detectable warning tiles causing a void between the underside of detectable warning tiles and concrete during and after the detectable warning tile installation and during the concrete curing stage,
10. Following detectable warning tile placement, review installation tolerances to Contract Documents and adjust detectable warning tiles before the concrete sets.

    a. Two suitable weights of 25 lbs (11.34 kg) each may be required to be placed on each detectable warning tile as necessary to ensure solid contact of the underside of detectable warning tiles and concrete.

11. Following the concrete curing stage, protective plastic wrap shall be removed from detectable warning tile surface by cutting the plastic with a sharp knife, tight to the concrete/detectable warning tile interface.

    a. If concrete bled under the plastic, a soft brass wire brush will clean the residue without damage to the detectable warning tile surface.

12. Individual detectable warning tiles shall be bolted together using 1/4 inch (6.35 mm) or equivalent hardware. This will help to ensure that adjacent detectable warning tiles are flush to each other during the installation process. Tape or sealant shall be placed on the underside of bolted butt joints to ensure that concrete does not rise up between the detectable warning tiles during installation. Any protective plastic wrap which was peeled back to facilitate bolting or cutting, shall be replaced and taped to ensure that the detectable warning tile surface remains free of concrete during the installation process.
13. Detectable warning tiles may be cut to custom sizes, or to make a radius, using a continuous rim diamond blade in a circular saw or mini-grinder. Use of a straightedge to guide the cut is advisable where appropriate.
14. Sound-amplifying plates on the underside of detectable warning tiles, which are dislodged during handling or cutting, shall be replaced and secured with construction adhesive.

    a. The air gap created between these plates and the bottom of detectable warning tiles is important in preserving the sound on cane audible properties as required in various jurisdictions.

15. Set each detectable warning tile accurately and firmly in place and completely seat detectable warning tile back and embedments in wet concrete by tamping or vibrating. If necessary, temporarily apply weight to detectable warning tiles to ensure full contact with concrete.

16. Set surface of detectable warning tiles flush with surrounding concrete and adjacent detectable warning tiles, with variations between detectable warning tiles and between concrete and detectable warning tiles not exceeding plus or minus 1/8 inch (3 mm) from flush.
17. Protect exposed surfaces of installed detectable warning tiles from contact with wet concrete. Complete finishing of concrete paving surrounding detectable warning tiles. Remove concrete from detectable warning tile surfaces.
18. Clean detectable warning tiles using methods recommended in writing by manufacturer.

B. Surface-Applied Detectable Warning Tiles:

1. Lay out detectable warning tiles as indicated and mark concrete pavement.

    a. Set the detectable warning tiles as indicated on the Drawings, so that location can be marked on the concrete surface. A thin permanent marker works well. Remove detectable warning tiles when done marking location.

2. Prepare existing paving surface by grinding and cleaning as recommended by manufacturer.

    a. The surface to receive the surface applied detectable warning tiles shall be mechanically cleaned with a diamond cup grinder or shot blaster to remove any dirt or foreign material.
    b. The cleaning and roughening of the concrete surface shall include not less than 4 inches (102 mm) around the perimeter of the area to receive the detectable warning tiles, and also along the cross pattern established by the corresponding areas on the backside of the detectable warning tiles. Those same areas should then be cleaned with a clean rag soaked in acetone.

3. Immediately prior to installing the surface applied detectable warning tiles, the concrete surfaces shall be inspected to ensure that they are clean, dry, free of voids, curing compounds, projections, loose material, dust, oil, grease, sealers and determined to be structurally sound and have cured for not less than 30 days.
4. Using acetone, wipe the backside of the detectable warning tiles around the perimeter and along the internal cross pattern, to remove any dirt or dust particles from the area to receive the adhesive.
5. Apply adhesive, provided by or recommended by detectable warning tile manufacturer, to back of detectable warning tiles in amounts and pattern recommended by manufacturer, and set detectable warning tiles in place. Firmly seat detectable warning tiles in adhesive bed, eliminating air pockets and establishing full adhesion to pavement. If necessary, temporarily apply weight to detectable warning tiles to ensure full contact with concrete.
6. Set the detectable warning tiles as indicated on the Drawings.
7. Install anchor devices through face of detectable warning tiles and into pavement using anchors located as recommended by manufacturer. Set heads of anchors flush with top surface of detectable warning tiles.

    a. Working from the center of the detectable warning tile outwards, drill and install all fasteners in the molded recesses in the detectable warning tiles.
    b. Standing with both feet applying pressure around the molded recess in the detectable warning tile, drill a hole true and straight to a depth of 3-1/2 inches (89 mm) using a 1/4 inch (6.35 mm) masonry drill bit. Drill through the detectable warning tile, without hammer option (on the drill), until the detectable warning tile has been successfully penetrated, then, with hammer option (on the drill), drill into the concrete.

        1) Maintaining foot pressure on both sides of the hole while drilling prevents concrete dust from accumulating between the detectable warning tile and concrete which can affect

the detectable warning tile being installed flush and may compromise installation integrity.

c. Immediately after drilling each hole, before moving on to the next, and while still applying foot pressure, mechanically fasten detectable warning tile to the concrete substrate using a leather bound or hard plastic mallet to set the fasteners. Ensure the fastener has been placed to full depth in the dome, straight, and flush to the top of dome. Drive the pin of the fastener with the mallet, taking care to avoid any inadvertent blows to the detectable warning tile surface.
d. Following the installation of the fasteners, the concrete dust should be vacuumed, brushed or blown away from the detectable warning tile surface and adjacent concrete. Using acetone on a rag, wipe the concrete around the detectable warning tile perimeter to ensure a clean, dry surface to receive perimeter sealant.

8. Mask perimeter of detectable warning tiles and adjacent concrete, and apply sealant provided by or recommended by detectable warning tile manufacturer, in continuous bead around perimeter of detectable warning tile installation.

a. Tape all perimeter edges of the detectable warning tiles back 1/16 inch (1.5875 mm) from the perimeter edge and tape the adjacent concrete back 1/2 inch (12.7 mm) from the perimeter edge to maintain a straight and even sealant line.
b. Apply sealant around detectable warning tile perimeter using care to work sealant into any void between the detectable warning tile and concrete interface.
c. Tool the sealant with a rounded plastic applicator or spatula to create a cove profile between the detectable warning tile and adjacent concrete.
d. Remove tape immediately after tooling perimeter sealant.

9. Remove masking, adhesive, excess sealant, and soil from exposed surfaces of detectable warning tiles and surrounding concrete pavement using cleaning agents recommended in writing by manufacturer.
10. Do not allow foot traffic on installed detectable warning tiles until the perimeter sealant has cured sufficiently to avoid tracking.

a. Curing time is weather dependent (average cure time at 75 deg F (24 deg C) is 30 minutes).
b. Adhesive and sealant on the surface of detectable warning tiles can be removed with acetone.

11. If installing adjacent detectable warning tiles, note the orientation of each detectable warning tile.

a. One of the long edges of the detectable warning tile is different than the other in regard to the tiny dotted texture. There is a larger perimeter margin before the tiny dotted texture pattern begins. Consistent orientation of each detectable warning tile is required in order that the truncated domes on adjacent detectable warning tiles line up with each other.

12. In order to maintain proper spacing between truncated domes on adjacent detectable warning tiles, the tapered edge should be trimmed off using a continuous rim diamond blade in a circular saw or mini-grinder.

a. The use of a straightedge to guide the cut is required.
b. All cuts should be made prior to installation of the detectable warning tiles.
c. When installing adjacent detectable warning tiles, leave a 1/8 inch (3.175 mm) gap between each detectable warning tile to allow for expansion and contraction.

13. If detectable warning tiles are custom cut to size, if pre-molded recesses (to receive fasteners) are removed by the cut, or to maintain a tight installation to the substrate then any truncated dome can be

center-drilled with a 1/4 inch (6.35 mm) masonry drill bit to create a through hole, and the through hole must be countersunk with a suitable carbide countersink bit to receive mechanical fasteners.

a. Care should be taken to not countersink too widely or deeply.
b. Fasteners should be flush with the top of the truncated dome when countersunk properly.

14. Protect installed detectable warning tiles from traffic until adhesive has set.

3.5 CLEANING AND PROTECTION

A. Remove and replace tactile warning surfacing that is cracked, broken, chipped, unbonded, damaged, otherwise defective, or does not comply with requirements in this Section. Remove in complete sections from joint to joint unless otherwise approved by Architect. Replace using tactile warning surfacing installation methods acceptable to Architect.

B. Upon completion of installation, clean detectable warning surfacing.

1. Comply with manufacturers maintenance manual for cleaning and maintaining detectable warning surfacing.

C. Clean detectable warning surfacing again not more than four days prior to Date of Substantial Completion.

1. Comply with manufacturers maintenance manual for cleaning and maintaining detectable warning surfacing.

D. Protect tactile warning surfacing from damage and maintain free of stains, discoloration, dirt, and other foreign material until Date of Substantial Completion in accordance with detectable warning surfacing manufacturer's instructions and recommendations.

1. Protect tactile warning surfacing from damage from rolling loads by covering with plywood or hardwood.

END OF SECTION 321726

SECTION 32 33 00 – SITE FURNISHINGS

PART 1 - GENERAL

1.1 GENERAL CONDITIONS

A. The requirements of the "General Conditions of the Contract" and of Division 1, "General Requirements", shall apply to all work of this Section with the same force and effect as though repeated in full herein.

1.2 SCOPE OF WORK

A. Furnish all labor, material, equipment and services necessary to provide site furnishings, complete in place, as shown on the Drawings or in this Specification.

B. Related work:
   1. Site Concrete
   2. Concrete Pavers
   3. Decomposed Granite
   4. Planting

1.3 SUBMITTALS

A. Submit Manufacturers' catalogue cuts or shop drawings indicating size, materials, finishes and quantities of items being supplied.

1.4 COORDINATION

A. The Contractor shall coordinate his work with other trades.

PART 2 - PRODUCTS

2.1 PICNIC TABLE

A. Picnic Table:
   1. Precast Concrete, per drawings.
   2. Color and finish: Natural
   3. Model number: QSTD90PT
   4. Manufacturer: QCP; (866-703-3434)
   5. Apply Graffiti Repellent Coating. Submit product for review.

B. Picnic Table ADA:
   1. Precast Concrete, per drawings.
   2. Color and finish: Natural
   3. Model number: QSTD90PTADA
   4. Manufacturer: QCP; (866-703-3434)
   5. Apply Graffiti Repellent Coating. Submit product for review.

2.2 FOOTINGS AND HARDWARE

A. Footings and hardware for secured installation.

B. Submit shop drawings for review.

2.3 MISCELLANEOUS

A. Anchors and adhesives required for installing and attaching the furnishings.

PART 3 - EXECUTION

3.1 DIMENSIONS

A. Dimensions shall be certified at the job site to insure proper placement, and fit of the equipment in the allotted areas.

3.2 INSTALLATION

A. Furnishings shall be installed per Manufacturer’s recommendations, unless otherwise noted on Drawings or Specification.

B. Work shall be set plumb and level, true to line and shall present a neat and finished appearance.

C. Set each item in its correct place, fastening it, connecting it, or incorporating it into other portions of the work.

D. Test and operate equipment to assure proper function.

3.3 PROTECTION

A. Adequately protect all work from damage by subsequent construction operations. Damaged work shall be replaced.

3.4 CLEAN-UP

A. The Contractor shall at all times keep the premises free from accumulation of waste materials and rubbish caused by his employees.

B. Upon completion of work, rubbish and excess materials are to be removed from the site, leaving the areas acceptably clean.

END OF SECTION 32 33 00

SECTION 32 84 00 - LANDSCAPE IRRIGATION

PART 1 - GENERAL

1.1 SUMMARY

A. It is the intent of the specifications and drawings that the finished system is complete in every respect and shall be ready for operation satisfactory to the District.

B. The work shall include all materials, labor, services, transportation, and equipment necessary to perform the work as indicated on the drawings, in these specifications, and as necessary to complete the contract.

1.2 CONSTRUCTION DRAWINGS

A. All offsets, fittings, sleeves, etc. which may be required are not shown on the drawings. The Contractor shall carefully investigate the structural and finished conditions affecting the work and plan the work accordingly, furnishing such fittings, etc. as may be required to meet such conditions. The work shall be installed in such a manner as to avoid conflicts between irrigation systems, planting, and architectural features.

B. All work called for on the drawings by notes or details shall be furnished and installed whether or not specifically mentioned in the specifications. When an item is shown on the plans but not shown on the specifications or vice versa, it shall be deemed to be as shown on both. The Landscape Architect shall have final authority for clarification.

C. The Contractor shall not willfully install the irrigation system as shown on the drawings when it is obvious in the field that obstructions, grade differences or discrepancies in area dimensions exist that might not have been considered in engineering. Such obstructions or differences should be brought to the attention of the Landscape Architect as soon as detected. In the event this notification is not performed, the Irrigation Contractor shall assume full responsibility for any revision necessary.

1.3 QUALITY ASSURANCE

A. Provide at least one English speaking person who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed and the manufacturer's recommended methods of installation and who shall direct all work performed under this section.

B. Manufacturer's directions and detailed drawings shall be followed in all cases where the manufacturer of articles used in this contract furnish directions covering points not shown in the drawings and specifications.

C. All local, municipal, and state laws, rules and regulations governing or relating to any portion of this work are hereby incorporated into and made a part of these specifications, and their provisions shall be carried out by the Contractor. Anything contained in these specifications shall not be construed to conflict with any of the above rules and regulations of the same. However, when these specifications and drawings call for or describe materials, workmanship, or construction of a better quality, higher standard, or larger size than is required by the above rules and regulations, the provisions of these specifications and drawings shall take precedence.

D. All materials supplied for this project shall be new and free from any defects. All defective materials shall be replaced immediately at no additional cost to District.

E. Secure the required licenses and permits including payments of charges and fees, give required notices to public authorities and verify permits secured or arrangements made by others affecting the work of this section.

1.4 SUBMITTALS

A. Water Pressure Test
   1. After award of contract and before any irrigation system materials are ordered from suppliers or delivered to the job site, submit to the District a written verification of the existing water pressure on the project at each of the points of connection shown.
   2. The water pressure test shall be performed to measure the dynamic water pressure at the point of connection at the maximum flow rate of the proposed irrigation system as shown on the point of connection note. Dynamic water pressure is when water is flowing through the point of connection. Static water pressure readings when water is not flowing, are not acceptable.
   3. Written dynamic water pressure test confirmation shall be made on the contractor's letterhead and include the flow rate during the test, the recorded water pressure, the date of the test and the time of the test.

B. Material List:
   1. After award of contract and before any irrigation system materials are ordered from suppliers or delivered to the job site, submit to the District a complete list of all irrigation system materials, or processes proposed to be furnished and installed as part of this contract.
   2. The submittal materials list shall include the following information:
      a. A title sheet with the job name, the contractor's name, contractor's address and telephone number, submittal date and submittal number.
      b. An index sheet showing the item number (e.g. 1,2,3, etc.); an item description (e.g. sprinkler head); the manufacturer's name (e.g. Hunter Industries); the item model number (e.g. I-40-ADV/36V); and the page(s) in the submittal set that contain the catalog cuts.
      c. The catalog cuts shall be one or two pages copied from the most recent manufacturer's catalog that indicate the product submitted. Do not submit parts lists, exploded diagrams, price lists or other extra information.
      d. The catalog cuts shall clearly indicate the manufacturer's name and the item model number. The item model number, all specified options and specified sizes shall be circled on the catalog cuts.
      e. Submittals for equipment indicated on the legend without manufacturer names, or "as approved", shall contain the manufacturer, Class or Schedule, ASTM numbers and/or other certifications as indicated in these specifications.
   3. Submittal materials list format requirements:
      a. Submittals shall be provided as one complete package for the project in electronic pdf format. Multiple partial submittals will not be reviewed.
      b. Submittal package shall have all pages numbered in the lower right hand corner. Page numbers shall correspond with submittal index.
      c. Re-submitted packages must be revised to include only the equipment being re-submitted. Equipment previously reviewed and accepted shall not be re-submitted in the materials list/index sheet or in the catalog cut sheet package.

C. Substitutions: If the Irrigation Contractor wishes to substitute any equipment or materials for those equipment or materials listed on the irrigation drawings and specifications, he may do so by providing the following information to the Landscape Architect or District's authorized representative for approval.
   1. Provide a written statement indicating the reason for making the substitution.
   2. Provide catalog cut sheets, technical data, and performance information for each substitute item.
   3. Provide in writing the difference in installed price if the item is accepted.

D. The Landscape Architect or District's authorized representative will allow no substitutions without prior written acceptance

E. No substitutions of pump manufacturers, distributors or assemblies will be accepted.

F. Manufacturer's warranties shall not relieve the Contractor of his liability under the guarantee. Such warranties shall only supplement the guarantee.

G. The Landscape Architect or District's authorized representative will not review the submittal package unless provided in the format described above.

1.5 EXISTING CONDITIONS

A. Verify and be familiar with the locations, size and detail of points of connection provided as the source of water, electrical supply, and ethernet connection to the irrigation system.

B. Irrigation design is based on the available static water pressure shown on the drawings. Contractor shall verify static water on the project prior to the start of construction. Should a discrepancy exist, notify the Landscape Architect and District's authorized representative prior to beginning construction.

C. Prior to cutting into the soil, locate all cables, conduits, sewer septic tanks, and other utilities as are commonly encountered underground, and take proper precautions not to damage or disturb such improvements. If a conflict exists between such obstacles and the proposed work, the Contractor shall promptly notify the Landscape Architect and District who will arrange for relocations. The Contractor will proceed in the same manner if a rock layer or any other such conditions are encountered.

D. Protect all existing utilities and features to remain on and adjacent to the project site during construction. Repair, at its own cost, all damage resulting from his operations or negligence.

E. The Irrigation Contractor shall coordinate with the General Contractor for installation of required sleeving as shown on the plans prior to paving operations.

F. Verify and be familiar with the existing irrigation systems in areas adjacent to and within the Project area of work.

G. Protect all existing irrigation systems, in areas adjacent to and within the project area of work, from damage due to his operations.

H. Notify District's Representative if any existing system is temporarily shut off, capped or modified. Provide 48-hour notice, prior to turning off or modifying any existing irrigation system.

I. Repair or replace all existing irrigation systems, in areas adjacent to and within the project area of work, damaged by the construction of this project. Adjacent irrigation systems shall be made completely operational and provide complete coverage of the existing landscaped areas. All repairs shall be complete to the satisfaction of the District's Representative.

J. Provide bore holes under any existing pavement or paving encountered for the required lateral, mainline and low voltage control wire sleeving. Bore holes under 2 inches in diameter and smaller shall be made with a BulletMole® underground boring tool as manufactured by Dimension Tools, LLC (Contact telephone number (888)-650-5554 or at www.bulletmole.com). Bore holes larger than 2 inches in diameter shall be made with an approved mechanical boring tool. No air jacking or hydraulic boring of any kind shall be allowed.

1.6 INSPECTIONS

A. The Contractor shall permit the Landscape Architect and District's authorized representative to visit and inspect at all times any part of the work and shall provide safe access for such visits.

B. Where the specifications require work to be tested by the Contractor, it shall not be covered over until accepted by the Landscape Architect, District's authorized representative, and/or governing agencies. The Contractor shall be solely responsible for notifying the Landscape Architect, District, and governing agencies, a minimum of 48 hours in advance, where and when the work is ready for testing. Should any work be covered without testing or acceptance, it shall be, if so ordered, uncovered at the Contractor's expense.

C. Inspections will be required for the following at a minimum:
1. Pre-construction meeting.
2. System layout.
3. Pressure test of irrigation mainline (Four hours at 125 PSI or 120% of static water pressure, whichever is greater.) Mainline pressure loss during test shall not exceed 2 PSI.
4. Coverage test of irrigation system. Test shall be performed prior to any planting.
5. Final inspection prior to start of maintenance period.
6. Final acceptance prior to turnover.

D. Site observations and testing will not commence without the field record drawings as prepared by the Irrigation Contractor. Record drawings must be complete and up to date for each site visit.

E. Work that fails testing and is not accepted will be retested. Hourly rates and expenses of the Landscape Architect, District's authorized representative, and governing agencies for re-inspection or retesting will be paid by the Irrigation Contractor at no additional expense to District.

1.7 STORAGE AND HANDLING

A. Use all means necessary to protect irrigation system materials before, during, and after installation and to protect the installation work and materials of all other trades. In the event of damage, immediately make all repairs and replacements necessary to the acceptance of the Landscape Architect and District and at no additional cost to the District.

B. Exercise care in handling, loading, unloading, and storing plastic pipe and fittings under cover until ready to install. Transport plastic pipe only on a vehicle with a bed long enough to allow the pipe to lay flat to avoid undue bending and concentrated external load.

1.8 CLEANUP AND DISPOSAL

A. Dispose of waste, trash, and debris in accordance with applicable laws and ordinances and as prescribed by authorities having jurisdiction. Bury no such waste material and debris on the site. Burning of trash and debris will not be permitted. Remove and dispose of rubbish and debris at frequent intervals or when ordered to do so by the District's authorized representative.

B. At the time of completion the entire site will be cleared of tools, equipment, rubbish and debris which shall be disposed of off-site in a legal disposal area.

1.9 TURNOVER ITEMS

A. Record Drawings:

1. Record accurately on one set of drawings all changes in the work constituting departures from the original contract drawings and the actual final installed locations of all required components as shown below.
2. The record drawings shall be prepared to the satisfaction of the District. Prior to final inspection of work, submit record drawings to the Landscape Architect or District's authorized representative.
3. All record drawings shall be prepared using AutoCAD 2018 drafting software and the original irrigation drawings as a base. No manual drafted record drawings shall be acceptable. The Contractor may obtain digital base files from the Landscape Architect or District's authorized representative.
4. If the Contractor is unable to provide the AutoCAD drafting necessary for the record drawings the irrigation designer does provide record drawing drafting as a separate service.
5. Prior to final inspection of work, submit record drawings plotted onto vellum sheets for review by the Landscape Architect or District's authorized representative. After acceptance by the Landscape Architect, City Inspector or District's authorized representative re-plot the record drawings onto reproducible Mylar sheets. The Contractor shall also provide record drawing information on a digital AutoCAD Release 2018 drawing file. All digital files shall be provided on a compact disc (CD) clearly marked with the project name, file descriptions and date.
    a. Record drawing information and dimensions shall be collected on a day-to-day basis during the installation of the pressure mainline to fully indicate all routing locations and pipe depths. Locations for all other irrigation equipment shall be collected prior to the final inspection of the work.
    b. Two dimensions from two permanent points of reference such as buildings, sidewalks, curbs, streetlights, hydrants, etc. shall be shown for each piece of irrigation equipment shown below. Where multiple components are installed with no reasonable reference point between the components, dimensioning may be made to the irrigation equipment. All irrigation symbols shall be clearly shown matching the irrigation legend for the drawings. All lettering on the record drawings shall be minimum 1/8 inch in size.
6. Show locations and depths of the following items:
    a. Point of connection (including water POC, backflow devices, master control valves, flow sensors, etc.)
    b. Routing of sprinkler pressure main lines (dimensions shown at a maximum of 100 feet along routing)
    c. Isolation valves
    d. Automatic remote control valves (indicate station number and size)
    e. Quick coupling valves
    f. Drip air relief and flush valves
    g. Routing of control wires where separate from irrigation mainline
    h. Irrigation controllers (indicate controller number and station count)
    i. Related equipment (as may be directed)

B. Controller Charts:
1. Provide one controller chart for each automatic controller. Chart shall show the area covered by the particular controller. The areas covered by the individual control valves shall be indicated using colored highlighter pens. A minimum of six individual colors shall be used for the controller chart unless less than six control valves are indicated.
2. Landscape Architect or District's authorized representative must approve record drawings before controller charts are prepared.
3. The chart is to be a reduced copy of the actual "record" drawing. In the event the controller sequence is not legible when the drawing is reduced, it shall be enlarged to a readable size.
4. When completed and approved, the chart shall be hermetically sealed between two pieces of plastic, each piece being a minimum 20 mils in thickness.

C. Operation and Maintenance Manuals:

1. Two individually bound copies of operation and maintenance manuals shall be delivered to the Landscape Architect or District's authorized representative at least 10 calendar days prior to final inspection. The manuals shall describe the material installed and the proper operation of the system.
2. Each complete, bound manual shall include the following information:
3. Index sheet stating Contractor's address and telephone number, duration of guarantee period, list of equipment including names and addresses of local manufacturer representatives.
    a. Operating and maintenance instructions for all equipment.
    b. Spare parts lists and related manufacturer information for all equipment.

D. Equipment:
1. Supply as a part of this contract the following items:
    a. Two (2) wrenches for disassembly and adjustment of each type of sprinkler head used in the irrigation system.
    b. Three 30-inch sprinkler keys for manual operation of control valves.
    c. Two keys for each automatic controller.
    d. Two quick coupler keys with a 1" bronze hose bib, bent nose type with hand wheel and two coupler lid keys.
    e. One valve box cover key or wrench.
    f. Six extra sprinkler heads of each size and type.
    g. For specified ball valves if required: One (1) 5-foot long valve handle, to fit the specified ball valves.
2. The above equipment shall be turned over to District's authorized representative at the final inspection.

1.10 COMPLETION

A. At the time of the pre-maintenance period inspection, the Landscape Architect, District's authorized representative, and governing agencies will inspect the work, and if not accepted, will prepare a list of items to be completed by the Contractor. Punch list to be checked off by contractor and submitted to Landscape Architect or District’s authorized representative prior to any follow-up meeting. This checked off list to indicate that all punch list items have been completed. At the time of the post-maintenance period or final inspection the work will be re-inspected and final acceptance will be in writing by the Landscape Architect, District's authorized representative, and governing agencies.

B. The District's authorized representative shall have final authority on all portions of the work.

C. After the system has been completed, the Contractor shall instruct District's authorized representative in the operation and maintenance of the irrigation system and shall furnish a complete set of operating and maintenance instructions.

D. Any settling of trenches which may occur during the one-year period following acceptance shall be repaired to the District's satisfaction by the Contractor without any additional expense to the District. Repairs shall include the complete restoration of all damage to planting, paving or other improvements of any kind as a result of the work.

1.11 GUARANTEE

A. The entire sprinkler system, including all work done under this contract, shall be unconditionally guaranteed against all defects and fault of material and workmanship, including settling of backfilled areas below grade, for a period of one (1) year following the filing of the Notice of Completion.

B. Should any problem with the irrigation system be discovered within the guarantee period, it shall be corrected by the Contractor at no additional expense to District within ten (10) calendar days of receipt

of written notice from District. When the nature of the repairs as determined by the District constitute an emergency (i.e. broken pressure line) the District may proceed to make repairs at the Contractor's expense. Any and all damages to existing improvement resulting either from faulty materials or workmanship, or from the necessary repairs to correct same, shall be repaired to the satisfaction of the District by the Contractor, all at no additional cost to the District.

C. Guarantee shall be submitted on Contractors own letterhead as follows:

GUARANTEE FOR SPRINKLER IRRIGATION SYSTEM

We hereby guarantee that the sprinkler irrigation system we have furnished and installed is free from defects in materials and workmanship, and the work has been completed in accordance with the drawings and specifications, ordinary wear and tear and unusual abuse, or neglect excepted. We agree to repair or replace any defective material during the period of one year from date of filing of the Notice of Completion and also to repair or replace any damage resulting from the repairing or replacing of such defects at no additional cost to the District. We shall make such repairs or replacements within 10 calendar days following written notification by the District. In the event of our failure to make such repairs or replacements within the time specified after receipt of written notice from District, we authorize the District to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand.

PROJECT NAME:
PROJECT LOCATION:

CONTRACTOR NAME:
ADDRESS:

TELEPHONE:

SIGNED:

DATE:

PART 2 - MATERIALS

2.1 SUMMARY

Use only new materials of the manufacturer, size and type shown on the drawings and specifications. Materials or equipment installed or furnished that do not meet Landscape Architect's, District's, or governing agencies standards will be rejected and shall be removed from the site at no expense to the District.

2.2 PIPE

A. Pressure supply line between the water meter and the backflow prevention device shall be type K copper, one size larger than backflow device.

B. Backflow prevention assemblies, and all other above grade assemblies, shall be constructed of threaded brass pipe and threaded brass fittings the same size as the backflow device, unless otherwise directed.

C. Pressure supply lines 1 1/2 inches in diameter and smaller downstream of the backflow prevention unit shall be Schedule 40 solvent weld PVC conforming to ASTM D1785.

D. Pressure supply lines 2 inches in diameter and up to 3 inches in diameter downstream of backflow prevention unit shall be Class 315 solvent weld PVC. Piping shall conform to ASTM D2241.

E. Non-pressure lines 3/4 inch in diameter and larger downstream of the remote control valve shall be SCH 40 solvent weld PVC conforming to ASTM D1785.

2.3 METAL PIPE AND FITTINGS

A. Brass pipe shall be 85 percent red brass, ANSI, IPS Standard 125 pounds, Schedule 40 screwed pipe.

B. Fittings shall be medium brass, screwed 125-pound class.

C. Copper pipe and fittings shall be Type "K" sweat soldered or brazed as indicated on the drawings.

2.4 PLASTIC PIPE AND FITTINGS

A. Pipe shall be marked continuously with manufacturer's name, nominal pipe size, schedule or class, PVC type and grade, National Sanitation Foundation approval, Commercial Standards designation, and date of extrusion.

B. All plastic pipe shall be extruded of an improved PVC virgin pipe compound in accordance with ASTM D2672, ASTM D2241 or ASTM D1785.

C. All solvent weld PVC fittings shall be standard weight Schedule 40 (and Schedule 80 where specified on the irrigation detail sheet, all mainline fittings shall be Schedule 80 PVC) and shall be injection molded of an improved virgin PVC fitting compound. Slip PVC fittings shall be the "deep socket" bracketed type. Threaded plastic fittings shall be injection molded. All tees and ells shall be side gated. All fittings shall conform to ASTM D2464 and ASTM D2466.

D. All threaded nipples shall be standard weight Schedule 80 with molded threads and shall conform to ASTM D1785.

E. All solvent cementing of plastic pipe and fittings shall be a two-step process, using primer and solvent cement applied per the manufacturer's recommendations. Cement shall be of a fluid consistency, not gel-like or ropy. Solvent cementing shall be in conformance with ASTM D2564 and ASTM D2855.

F. When connection is plastic to metal, female adapters shall be hand tightened, plus one turn with a strap wrench. Joint compound shall be non-lead base Teflon paste, tape, or equal.

G. All pressure mainlines installed with solvent weld PVC fittings shall be installed with concrete thrust blocking at all directional changes in the mainline routing. Concrete thrust blocking shall not be required when ductile iron fittings and mechanical restraints are specified.

2.5 BACKFLOW PREVENTION UNITS

A. The backflow prevention unit shall be of the manufacturer, size, and type indicated on the drawings.

B. The backflow prevention unit shall be installed in accordance with the requirements set forth by local codes.

C. The backflow enclosure shall be of the manufacturer, size, and type indicated on the drawings.

2.6 VALVES

A. Ball Valves:
   1. Ball valves shall be of the manufacturer, size, and type indicated on the drawings.
   2. All ball valves shall have a minimum working pressure of not less than 150 PSI and shall conform to AWWA standards.

B. Quick Coupler Valves:
   1. Quick coupler valves shall be of the manufacturer, size, and type indicated on the drawings.
   2. Quick coupler valves shall be brass with a wall thickness guaranteed to withstand normal working pressure of 150 psi without leakage. Valves shall have 1” female threads opening at base, with two-piece body. Valves to be operated only with a coupler key, designed for that purpose. Coupler key is inserted into valve and a positive, watertight connection shall be made between the coupler key and valve.

C. Automatic Control Valves:
   1. Automatic control valves shall be of the manufacturer, size, and type indicated on the drawings.
   2. Automatic control valves shall be electrically operated.
   3. Provide Christy's valve ID tags for each remote control valve with valve number.

2.7 VALVE BOXES

A. Valve boxes shall be fabricated from a durable, weather-resistant plastic material resistant to sunlight and chemical action of soils.

B. The valve box cover shall be green in color and secured with a hidden latch mechanism or bolts.

C. Valve box extensions shall be by the same manufacturer as the valve box.

D. The plastic irrigation valve box cover shall be an overlapping type.

E. Automatic control valve, master valve, and flow sensor boxes shall be 17"x11"x12" nominal rectangular size. Valve boxes for drip valve assemblies shall be Jumbo valve boxes size as required to fit assemblies. Valve box covers shall be marked "RCV" with the valve identification number, or “MV”, “FS” "heat branded" onto the cover in 1-1/4 inch high letters / numbers.

F. Quick coupler and ball valve boxes shall be 10" circular size. Valve box covers shall be marked with "QCV" or “BV” "heat branded" onto the cover in 1-1/4 inch high letters.

2.8 AUTOMATIC CONTROLLER

A. Automatic controller shall be of the manufacturer, size, and type indicated on the drawings.

B. Controller enclosure shall be of the manufacturer, size, and type indicated on the drawings.

C. Controller shall be grounded according to local codes using equipment of the manufacturer, size, and type indicated on the drawings; or as required by local codes and ordinances.

2.9 ELECTRICAL

A. All electrical equipment shall be NEMA Type 3, waterproofed for exterior installations.

B. All electrical work shall conform to local codes and ordinances.

2.10 LOW VOLTAGE CONTROL WIRING

A. Remote control wire shall be direct-burial AWG-UF type, size as indicated on the drawings, and in no case smaller than 14 gauge.

B. Connections shall of the manufacturer, size, and type indicated on the drawings.

C. Common wires shall be white in color. Control wires shall be red (where two or more controllers are used, the control wires shall be a different color for each controller. These colors shall be noted on the "Record Drawings" plans located on controller door).

D. Ground wires shall be green in color or bare copper and in no case smaller than 6 gauge.

2.11 IRRIGATION HEADS, DRIP EMITTERS, AND INLINE DRIP TUBING

A. Irrigation heads, drip emitters, and inline drip tubing shall be of the manufacturer, size, type, with radius of throw, operating pressure, and discharge rate indicated on the drawings.

B. Irrigation heads, drip emitters, and inline drip tubing shall be used as indicated on the drawings.

2.12 DRIP IRRIGATION EQUIPMENT

Drip tubing equipment such as flush valves, air relief valves, wye strainers and pressure regulators shall be of the manufacturer, size, and type indicated on the drawings.

2.13 MISCELLANEOUS EQUIPMENT

A. Landscape Fabric:
1. Landscape fabric for valve box assemblies shall be 5.0- oz. weight woven polypropylene weed barrier. Landscape fabric shall have a burst strength of 225 PSI, a puncture strength of 60 lbs. and capable of water flow of 12 gallons per minute per square foot.
2. Type: DeWitt Pro 5 Weed Barrier or approved equal.

B. Equipment such as flow sensors, rain sensors, flush valves, wye strainers, and master valves shall be of the manufacturer, size and type indicated on the drawings.

PART 3 - EXECUTION

3.1 SITE CONDITIONS

A. Inspections:
1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
2. Verify that irrigation system may be installed in strict accordance with all pertinent codes and regulations, the original design, the referenced standards, and the manufacturer's recommendations.

B. Discrepancies:
1. In the event of discrepancy, immediately notify the Landscape Architect or District's authorized representative.
2. Do not proceed with installation in areas of discrepancy until all discrepancies have been resolved.

C. Grades:

1. Before starting work, carefully check all grades to determine that work may safely proceed, keeping within the specified material depths with respect to finish grade.
2. Final grades shall be accepted by the Engineer before work on this section will be allowed to begin.

D. Field Measurements:
1. Make all necessary measurements in the field to ensure precise fit of items in accordance with the original design. Contractor shall coordinate the installation of all irrigation materials with all other work.
2. All scaled dimensions are approximate. The Contractor shall check and verify all size dimensions prior to proceeding with work under this section.
3. Exercise extreme care in excavating and working near existing utilities. Contractor shall be responsible for damages to utilities, which are caused by his operations or neglect.

E. Diagrammatic Intent:
The drawings are essentially diagrammatic. The size and location of equipment and fixtures are drawn to scale where possible. Provide offsets in piping and changes in equipment locations as necessary to conform with structures and to avoid obstructions or conflicts with other work at no additional expense to District.

F. Layout:
1. Prior to installation, the Contractor shall stake out all pressure supply lines, routing and location of sprinkler heads, valves, backflow preventer, and automatic controller.
2. Layout irrigation system and make minor adjustments required due to differences between site and drawings. Where piping is shown on drawings under paved areas, but running parallel and adjacent to planted areas, install the piping in the planted areas.

G. Water Supply:
Connections to, or the installation of, the water supply shall be at the locations shown on the drawings. Minor changes caused by actual site conditions shall be made at no additional expense to District.

H. Electrical Service:
1. Connections to the electrical supply shall be at the locations shown on the drawings. Minor changes caused by actual site conditions shall be made at no additional expense to District.
2. Contractor shall make electrical connections to the irrigation controller. Electrical power source to controller locations shall be provided by others.
3. Contractor shall make electrical connections to the irrigation controller. 230-volt single-phase electrical power source to pump assembly location shall be provided by others per NEC codes.

3.2 TRENCHING

A. Excavations shall be straight with vertical sides, even grade, and support pipe continuously on bottom of trench. Trenching excavation shall follow layout indicated on drawings to the depths below finished grade and as noted. Where lines occur under paved area, these dimensions shall be considered below subgrade.

B. Provide minimum cover of 18 inches on pressure supply lines 2 ½ inches and smaller.

C. Provide minimum cover of 18 inches for control wires within planters.

D. Provide minimum cover of 24 inches for control wires within sleeves below paving.

E. Provide minimum cover of 36 inches on pressure supply lines under vehicular travel ways.

F. Provide minimum cover of 12 inches for non-pressure lines.

G. Pipes installed in a common trench shall have a 4-inch minimum space between pipes.

3.3 THRUST BLOCKS

A. Thrust blocks must be constructed of Class “B” concrete.

B. Thrust blocks shall be poured against undisturbed site soil.

C. PVC fitting joints shall be kept free of concrete. Do not encase fitting in concrete.

D. Thrust blocking shall be sized to provide the minimum bearing areas as shown below. Bearing areas indicated have been calculated for Class 200 PVC pipe at a test pressure of 150 PSI in soil with 2,000 PSI bearing capacity. Increase thrust block sizing as necessary for varying soil conditions.
   1. Provide a minimum thrust block bearing area of 2.0 square feet on all bends (all degrees) and tees installed on pressure supply lines 4 inches and smaller.

3.4 BACKFILLING

A. Backfill material on all lines shall be the same as adjacent soil free of debris, litter, and rocks over 1/2 inches in diameter.

B. Backfill shall be tamped in 4-inch layers under the pipe and uniformly on both sides for the full width of the trench and the full length of the pipe. Backfill materials shall be sufficiently damp to permit thorough compaction, free of voids. Backfill shall be compacted to dry density equal to adjacent undisturbed soil and shall conform to adjacent grades.

C. Flooding in lieu of tamping is not allowed.

D. Under no circumstances shall truck wheels be used to compact backfill.

E. Provide sand backfill a minimum of 4 inches over and under all piping under paved areas.

3.5 PIPING

A. Piping under existing pavement may be installed by jacking, boring, or hydraulic driving. No hydraulic driving is permitted under asphalt pavement.

B. Cutting or breaking of existing pavement is not permitted.

C. Carefully inspect all pipe and fittings before installation, removing dirt, scale, burrs, and reaming. Install pipe with all markings up for visual inspection and verification.

D. Remove all dented and damaged pipe sections.

E. All lines shall have a minimum clearance of 4 inches from each other and 12 inches from lines of other trades.

F. Parallel lines shall not be installed directly over each other.

G. In solvent welding, use only the specified primer and solvent cement and make all joints in strict accordance with the manufacturer's recommended methods including wiping all excess solvent from

each weld. Allow solvent welds at least 15 minutes setup time before moving or handling and 24 hours curing time before filling.

H. PVC pipe shall be installed in a manner, which will provide for expansion and contraction as recommended by the pipe manufacturer.

I. Center load all plastic pipe prior to pressure testing.

J. All threaded plastic-to-plastic connections shall be assembled using Teflon tape or Teflon paste.

K. For plastic-to-metal connections, work the metal connections first. Use a non-hardening pipe dope an all threaded plastic-to-metal connections, except where noted otherwise. All plastic-to-metal connections shall be made with plastic male adapters.

3.6 CONTROLLER

A. The exact location of the controller shall be approved by the Landscape Architect or District's authorized representative before installation. The electrical service shall be coordinated with this location.

B. The Irrigation Contractor shall be responsible for the final electrical hook up to the irrigation controller.

C. The irrigation system shall be programmed to operate during the periods of minimal use of the design area.

3.7 CONTROL WIRING

A. Low voltage control wiring shall occupy the same trench and shall be installed along the same route as the pressure supply lines whenever possible.

B. Where more than one wire is placed in a trench, the wiring shall be taped together in a bundle at intervals of 10 feet. Bundle shall be secured to the mainline with tape at intervals of 20 feet.

C. All connections shall be of an approved type and shall occur in a valve box. Provide an 18-inch service loop at each connection.

D. An expansion loop of 12 inches shall be provided at each wire connection and/or directional change, and one of 24 inches shall be provided at each remote control valve.

E. A continuous run of wire shall be used between a controller and each remote control valve. Under no circumstances shall splices be used without prior approval.

3.8 VALVES

A. Automatic control valves, quick coupler, and ball valves are to be installed in the approximate locations indicated on the drawings.

B. Valve shall be installed in shrub areas whenever possible.

C. Install all valves as indicated in the detail drawings.

D. Valves to be installed in valve boxes shall be installed one valve per box.

E. Provide valve ID tags for each remote control valve with valve number.

3.9 VALVE BOXES

A. Valve boxes shall be installed in shrub areas whenever possible.

B. Each valve box shall be installed on a foundation of 3/4 inch gravel backfill, 3 cubic feet minimum. Valve boxes shall be installed with their tops 1/2 inch above the surface of surrounding finish grade in lawn areas and 2 inches above finish grade in ground cover areas.

3.10 IRRIGATION HEADS, DRIP EMITTERS, AND INLINE DRIP TUBING

A. Irrigation heads, drip emitters, and inline drip tubing shall be installed as indicated on the drawings.

B. Spacing of heads and inline drip tubing shall not exceed maximum indicated on the drawings.

C. Riser nipples shall be of the same size as the riser opening in the sprinkler body.

3.11 BACKFLOW PREVENTION UNITS

A. Backflow Prevention Units shall be installed as indicated on the drawings. The backflow prevention unit shall be installed in accordance with the requirements set forth by local codes.

B. The exact location of the backflow device shall be approved by the Landscape Architect or District's authorized representative before installation.

C. The Contractor shall be responsible for the testing and certification of the backflow device for proper operation. Testing and certification shall be performed by a state qualified backflow tester.

3.12 MISCELLANEOUS EQUIPMENT

A. Install all assemblies specified herein according to the respective detail drawings or specifications, using best standard practices.

B. Quick coupler valves shall be set approximately 18 inches from walks, curbs, header boards, or paved areas where applicable.

C. Install devices such as rain sensors, flush valves, master valves, and flow sensors as indicated on the drawings and as recommended by the manufacturer.

3.13 FLUSHING THE SYSTEM

A. Prior to installation of irrigation heads, the valves shall be opened and a full head of water used to flush out the lines and risers.

B. Irrigation heads shall be installed after flushing the system has been completed.

3.14 ADJUSTING THE SYSTEM

A. Adjust valves, align heads, and check the coverage of each system prior to coverage test.

B. If it is determined by the Landscape Architect or District's authorized representative that additional adjustments or nozzle changes will be required to provide proper coverage, all necessary changes or adjustments shall be made prior to any planting.

C. The entire system shall be operating properly before any planting operations commence.

D. Automatic control valves are to be adjusted so that the irrigation heads, drip emitters, and inline drip tubing operate at the pressure recommended by the manufacturer.

3.15 TESTING AND OBSERVATION

A. Do not allow or cause any of the work of this section to be covered up or enclosed until it has been observed, tested and accepted by the Landscape Architect, District, and governing agencies.

B. The Contractor shall be solely responsible for notifying the Landscape Architect, District, and governing agencies, a minimum of 48 hours in advance, where and when the work is ready for testing.

C. When the sprinkler system is completed, perform a coverage test of each system in its entirety to determine if the water coverage for the planted areas is complete and adequate in the presence of the Landscape Architect.

D. Furnish all materials and perform all work required to correct any inadequacies of coverage due to deviations from the plans, or where the system has been willfully installed as indicated on the drawings when it is obviously inadequate, without bringing this to the attention of the Landscape Architect. This test shall be accepted by the Landscape Architect and accomplished before starting any planting.

E. Areas to be maintained for the formal maintenance period shall start maintenance at the same time, as directed by the Landscape Architect, District, and governing agencies. Partial areas will not be released into maintenance prior to completion of items listed in the pre-maintenance review. The maintenance period may not be phased.

F. If, after the maintenance review, the irrigation systems are not accepted by the Landscape Architect, the Contractor shall reimburse the Architect for additional site visits, or additional time required to review work. All additional time will be billed at the Architect's hourly rate and will be paid for by the Contractor at no additional cost to the District.

G. Final inspection will not commence without record drawings as prepared by the Irrigation Contractor.

3.16 MAINTENANCE

During the maintenance period the Contractor shall adjust and maintain the irrigation system in a fully operational condition providing complete irrigation coverage to all intended plantings.

3.17 COMPLETION CLEANING

Clean up shall be made as each portion of the work progresses. Refuse and excess dirt shall be removed from the site, all walks and paving shall be swept, and any damage sustained on the work of others shall be repaired to original conditions.

END OF SECTION

This page intentionally left blank.

SECTION 32 90 00 – LANDSCAPE PLANTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes materials, soil and installation in over-structure planters, soil preparation, planting, palm planting, seeding, sodding, staking and guying, and cleanup.
   1. Planting occurs at street level and on upper building levels.

B. Related work:
   1. Section 32 01 90: Landscape Maintenance
   2. Section 32 84 00: Irrigation System

C. Definitions:
   1. Architect: the Architect or the Owner's authorized representative.
   2. Soil Test: Required testing performed by Contractor after site is rough graded. A current soil report is also required for import soil prior to transport to the site.
   3. Punch List: List of work within the Contract, generated by Architect that needs to be completed, repaired, replaced, or rectified by Contractor.
   4. Pre-maintenance review: Observation by Architect to verify substantial completion of the Work. The Architect will generate a Punch List during this review. Maintenance Period will commence when Contractor has completed items on this Punch List and Architect has verified that the Punch List is complete.
   5. Maintenance Period: See Specification section 32 01 90.
   6. Final Acceptance: Observation review by Architect at end of the specified Maintenance Period to verify completion and acceptance of the Work.

1.2 QUALITY ASSURANCE

A. Standards:
   1. Provide plants and planting materials that meet or exceed specifications of Federal, State, and County laws requiring inspection for plant disease or insect control.
   2. Provide quality and size conforming to current edition of “Horticultural Standards” for number one nursery stock as adopted by the American Association of Nurserymen.
   3. Provide plants that are true to name. Tag one of each bundle or lot with the name and size of plants in accordance with the standards of practice of the American Association of Nurserymen.
   4. Botanical names shall take precedence over common names.

B. Workmanship: Perform work in accordance with the best standards of practice for landscape work and under the continual supervision of a competent foreman capable of interpreting the Drawings and Specifications.

C. Quantities and Types: Plant materials shall be furnished in the quantities and/or spacings as shown or noted for each location, and shall be of the species, kinds, sizes, etc., as symbolized and/or described in the Plant List, and as indicated on the Drawings.

D. Verification of dimensions and quantities: scaled dimensions are approximate. Before proceeding with work, carefully check and verify dimensions and quantities and immediately inform the Architect of discrepancies between the Drawings and/or specifications and actual conditions. Do not start work in areas where there are discrepancies until approval for same has been given by the Architect.

1.3 SUBMITTALS

A. Submit documentation to Architect 60 days before start of planting that plant material is available. Include:
   1. A list of plants stating quantity, size, and supplier.
      a. Requests for substitutions due to unavailability must be made in writing.
      b. Substitutions may not be made without approval of the Architect.
      c. Contractor shall notify Architect 24 hours in advance of delivery of plant materials, and shall submit an itemized list of plants in each delivery.
   2. Photographs of trees 24" box and larger.
      a. Label each photo with plant name, plant height, spread and trunk caliper.
      b. Label each photo with nursery name, nursery contact and phone number.
      c. Photograph shall include a person in picture for scale purposes.

B. Soil Test: Contractor shall have import soil and the soil of the site tested for fertility, agricultural suitability, and appraisal by Soil and Plant Laboratory Inc. (714) 282-8777, or Wallace Labs (310) 615-0116.
   1. Submit a copy of the Planting Plan and Plant Legend to the laboratory with the samples.
   2. Soil report shall include:
      a. pH measurement.
      b. Nutrients and elements:
         1) Measurement (low, medium, high) of: Boron, calcium, copper, iron, magnesium, manganese, molybdenum, phosphorus, potassium, sodium, sulfur, and zinc.
         2) Analyze saturation extract for: calcium, magnesium, sodium, boron, chloride, phosphorus, nitrate and sulfate.
         3) Trace metals: Aluminum, arsenic, cadmium, chromium, cobalt, lead, lithium, nickel, selenium, silver, strontium, tin and vanadium.
         4) The presence of calcium carbonate and/or magnesium carbonate.
      c. Soil Texture (gravel, sand, silt and clay). Determine organic matter content by the measurement of organic carbon. The quality of the organic matter shall be determined by measuring organic carbon and total nitrogen.
         1) Methods of Soil Analysis, Part 1, Physical and Mineralogical Methods, Soil Science Society of America, Inc., 1986, chapter 36, pgs 901-926 and Methods of Soil Analysis, Part 3 Chemical Methods, Soil Science Society of America, Inc, 1996, chapter 34, pgs 965-977 & pgs 1001-2 and chapter 37, pg 1088
      d. Interpretation and recommendations for correction of nutritional deficiencies/ excesses and potential toxicities.
   3. Soil shall be tested from a minimum of four (4) locations per acre of planted area. Contractor shall record locations where samples were taken.
   4. A copy of the soil test results shall be submitted to the Owner and Architect before work begins.
   5. Contractor shall pay cost of soil tests.

C. Cut sheets of materials to be used: tree stakes, tree guys, root barriers, amendments, mycorrhizal fungi, etc.

D. Legible copies of delivery slips for soil amendments, including mycorrhizal fungi.

E. The Contractor shall submit samples or specifications of items being used upon the request of the Architect, and as required by this Part 2 of this Specification.

1.4 OBSERVATION SCHEDULE

A. Contractor shall be responsible for notifying the Architect, in advance, for the following observations, according to the time indicated:
   1. Pre-construction conference – seven (7) days
   2. Tree tagging at nursery (trees 24" box size and larger) – 48 hours
   3. Final grade, soil preparation and planting area layout review - 72 hours
   4. Plant materials review - 48 hours
   5. Plant layout review - 48 hours
   6. Planting operations - 48 hours
   7. Completed planting (Pre-maintenance) walk through – seven (7) days

B. Contractor shall be responsible for scheduling site Observation visits with Architect as work progresses. Failure to schedule required Observations shall not relieve Contractor of responsibility for obtaining approvals. Contractor shall redo, at no cost to the Owner, work that does not satisfy the Owner.

C. Observations may be waived or combined at the discretion of the Architect.

D. When someone other than the Architect conducts Observations, the Contractor shall show evidence in writing of when and by whom these observations were made.

E. No site visits shall commence without adequate preparation or items noted in previous Observation Reports, either completed or remedied, unless the Owner has waived such compliance. Failure to adequately prepare or accomplish previous punch list items shall make the Contractor responsible for reimbursing the Architect for the site visit at his current billing rates per hour plus transportation costs. No further inspections will be scheduled until this charge has been paid and received.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver fertilizer or soil amendments to site in original unopened containers bearing manufacturer's guaranteed chemical analysis, name, trademark, and conformance to state law. Protect material from damage or breakage. Immediately remove empty containers from site.

B. Deliver plants with legible identification labels. Store plant material in shade and protect from weather or injury. Maintain in a healthy, vigorous condition. Architect may at time reject plant material not maintained in this condition.

C. Handling: Do not drop plants or pick up container plants by their stems or trunks.

1.6 SAMPLES AND TESTS:

A. Contractor shall submit soil samples for testing, per this Specification.

B. Architect reserves the right to take and analyze samples of materials for conformity to specifications at any time. Contractor shall furnish samples upon request by Architect.

C. Rejected materials shall be immediately removed from the site at the Contractor's expense.

D. Contractor shall pay cost of testing or replacement of materials not meeting specifications.

1.7 WARRANTY AND REPLACEMENT

A. Contractor shall fully warrant and agree to replace poor, inadequate, or defective materials and workmanship for one year from date of acceptance of completed planting work.

B. Replacement: Materials found to be dead, missing, or in poor condition during the establishment period shall be replaced immediately. The Architect shall be the sole judge as to the condition of material. Material to be replaced during the warranty period shall be replaced by the Contractor within fifteen days of written notification by Owner.

PART 2 - PRODUCTS

2.1 SOIL

A. Site Soil:
1. Site soil used to form landscape planting areas or backfill planters shall be clean, fertile, loamy soil, free of stones, sticks, stumps, or other deleterious matter one inch in diameter or larger. It shall also be free from wire, plaster, construction debris, or similar objects that would be a hindrance to planting or maintenance.
2. The Architect shall approve suitability of soil of the site after reviewing results of the soil test.

B. Import Top Soil: Clean, fertile, sandy loam soil, free of stones or other deleterious matter one inch in diameter or larger. It shall also be free of pockets of coarse sand, noxious weeds, sticks, lumber, brush and other litter. It shall not be infested with nematodes or other undesirable disease-causing organisms such as insects and plant pathogens. Import top soil must conform to the following:
1. Particle size
   a. Class Particle SizeRange Maximum % Minimum %
   b. Coarse sand 0.5 - 2.0mm 15 0
   c. Silt plus clay <0.05mm 50 15
   d. Other classes:
   e. Gravel 2-13mm 15 0
   f. Rock 1/2 - 1” 5% by volume with none > 1”
2. Chemistry
   a. Salinity: Saturation Extract Conductivity (ECe) - less than 3.0 sD/m @ 25° C
   b. Sodium: Sodium Absorption Ratio (SAR) - less than 6.0
   c. Boron: Saturation Extract Concentration - Less than 1.0 ppm
   d. Reaction: pH of Saturated Paste - 5.5-7.8 without high lime content
3. Soil shall contain sufficient quantities of available nitrogen, phosphorus, potassium, calcium and magnesium to support normal plant grown. In the event of nutrient inadequacies, provisions shall be made to add required material prior to planting.
4. In order to insure conformance, samples of the import soil shall be submitted to an approved laboratory for analysis prior to and following backfilling.
5. Obtain imported topsoil from approved local sources.

C. Units are mg/kg dry weight determined with Ammonium bicarbonate DTPA extraction

D. Backfill for at grade trees and shrubs shall be per Soils Report.

E. Special mixes: see Drawings.

2.2 SOIL AMENDMENTS

A. Soil amendments shall be as required by Soils Test.

B. Contractor shall provide amendments recommended by Soils Report at no additional cost to Owner, including recommendations for the quality of organic amendment.

C. Mycorrhizal fungi shall be added in all planting areas, regardless of Soils Report. Mycorrhizal inoculum consists of a combination of :
   1. Innoculum shall contain a blend of eight top types of Endospores: Glomus aggregatum, G. clarum, G. deserticola, G. intraradices, G. monosporus, G. mosseae, Gigaspora margarita, and Paraglomus brasilianum, and seven top types of Ecto fungi spores:Lacarria laccata, Pisolithus tinctorius, Rhizopogon amylpogon, R. fulvigleba, R. rubescens, R. villosuli, and Scleroderma spp. The guaranteed Endo spore count shall be a minimum 50 spores/cc, and the Ecto spore count shall be a minimum 50,000 spores/cc
   2. Manufacturers:
      a. BioOrganics Mycorrhizae Inoculants, (888) 332-7676
      b. Mycorrhizal Applications, Inc, (866) 476-7800
      c. Or equal.

2.3 PLANT TABLETS

A. 7 gram planting tablet designed for 12 month slow release. 12-8-8 NPK, 20% humus, 4% humic acids, 3.5% sulfur, 2% iron, micronutrients.

2.4 PLANT MATERIAL:

A. Plants shall be in conformance with the California State Department of Agriculture's regulation for nursery inspections, rules, and ratings. Plants shall be healthy, vigorous, and free of insect infestations, plant diseases, sunscalds, frostburns, abrasions, or other disfigurement. Plants shall be grown in climatic conditions similar to that of the planting site, and well hardened off. Plants shall have vigorous fibrous root systems which are not rootbound or potbound. The Architect is the sole judge as to acceptability of plant material.

B. The size of the plants will correspond with that normally expected for species and variety of commercially available nursery stock or as specified on Drawings.

C. The Architect shall approve plant material prior to planting. Plants shall be subject to review and approval of Architect at place of growth or upon delivery for conformity to specifications, and for injury, insect infestation, and trees and shrubs for improper pruning. Such approval shall not impair the right of review and rejection during progress of the work. Architect reserves the right to refuse review if, in his/her judgment, a sufficient quantity of plants is not available for review.

D. Plants not conforming to the requirements herein specified shall be considered defective, and such plants, whether in place or not, shall be marked as rejected and immediately removed from the site and replaced with new plants at the Contractor's expense.

E. Plant material shall be true to botanical and common name and variety as specified in "Sunset Western Garden Book."

F. Substitute plant material will not be permitted unless specifically approved in writing by the Architect.

2.5 GUYING AND STAKING MATERIALS:

A. Wood tree stakes: Lodgepole pine, fully treated with CuNap, ACQ or other non-arsenic wood preservative. Do not use split stakes.
   1. 24" box trees and smaller: 2" (nom.) diameter by 10' long.
   2. 36" box trees: 3" (nom.) diameter by 12' long.

B. Tree Ties:
   1. Flexible vinyl tree ties meeting ASTM-D-412 standards for tensile and elongation strength. Material shall be black.
   2. Each tie shall be a single piece, not multiple ties joined together.
   3. Manufacturers: VIT Cinch Tie, VIT Cinch Belt (larger trees), Villa Root Barrier E-Z Band, or equal.

2.6 WATER:

A. Furnished by Owner.

B. Transport by Contractor as required.

2.7 MULCH:

A. Decorative Bark:
   1. Walk-On-Bark as supplied by Sequoia Forest Products, telephone: (559) 591-1177.
   2. Small Bark product #083 by Kellogg Supply, Inc., telephone: (310) 830-2200.
   3. Small Deco Bark by Aguinaga Fertilizer Company, (949) 786-9558.

B. Composted, shredded tree trimmings:
   1. Forest Floor 0-2" by Aguinaga Fertilizer Company, (949) 786-9558.

C. Submit mulch samples for approval by Architect. No shredded lumber products will be accepted.

D. Rock mulches: per Plans.

2.8 METAL EDGING:

A. Steel edging shall be 3/16" x 5 ½", black color, with 18" steel stake.
   1. Manufacturer: Sure-Loc. (800) 787-3562.

2.9 DRAINAGE MATERIAL

A. 3/8" crushed rock:
   1. 95% -100% passing through a 3/8" screen.
   2. 0-5% passing through No. 8 mesh.
   3. 80-100# per cubic yard.

2.10 SOIL SEPARATOR:

A. Nonwoven polypropylene fabric, needle-punched, with UV Resistance of 70%, AOS of 70 US Standard sieve, water flow rate of 110 gpm/ft2.
   1. Geotex 701, manufactured by Propex, or equal.

2.11 EROSION CONTROL FABRICS

A. Jute mesh.
   1. Specification Test Method Typical Values
      a. Yarn Fiber Woven jute, undyed and unbleached
      b. Yarn Count, Warp 78 per width, minimum
      c. Yarn Count, Weft 42 per linear yard, minimum
      d. Color Natural(Brown, Earth Tone)
      e. Fabric Width (in) 48
      f. Fabric Weight (lb/yd2) 92
      g. Strands/ft, Warp 19.5
      h. Strands/ft, Weft 14.0
      i. Mass/Unit Area (oz/yd2) 14.7
      j. Wide Width Tensile, Dry (lb/ft)
      k. Warp x Fill ASTM D 4595 300 x 175
      l. Wide Width Tensile, Wet (lb/ft)
      m. Warp x Fill ASTM D 4595 125 x 65
      n. Elongation at Break (%) 10 x 10
      o. Open Area (%) 60 - 65
      p. Durability(yr) 1 - 2
      q. Water Velocity (ft/sec) 8
      r. Unit Shear Test (lb/ft2) 0.45
      s. “C” Factor, 1.5:1 slope 0.005

2.12 WEED CONTROL FABRIC

A. Spun-bonded polypropylene with UV inhibitors, non-degrading geotextile fabric that blocks 95% of weed growth and is permeable to air, water, gasses and fertilizer. Typar 3301 or equal.

B. Properties:
   1. Unit Weight: 3.0 oz/yds2
   2. Tensile Strength: 135 pounds
   3. Puncture Strength: 35 pounds
   4. Air Opening Size: 60/70 equivalent sieve
   5. Elongation at Break: <70%
   6. Trap Tear: 50 pounds
   7. Flux: 70 gal/ft2/min
   8. Permitivity: 1.2 sec-2
   9. Color: Black

2.13 ROOT BARRIER

A. Polyethylene (0.08 inch thick) or polypropylene (2.032 - 2.16 mm thick), with self-locking joiners, ½” raised 90 degree molded root deflecting ribs, ground lock tabs, double top edge, UV inhibitors. Use 24" barrier unless otherwise stated.

2.14 TREE TRUNK PROTECTOR

A. 9" height with 4" diameter, expandable, ventilated, 1.52 mm thick UV inhibited polyethylene, gray-brown color. Arbor Guard by Deep Root Corp (800) 458-7668. TP-128 by NDS (800) 726-1994, or equal.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION:

A. Site acceptance:
   1. The Contractor shall be responsible for coordinating his work with the General Contractor and other Sub-Contractors so no damage occurs to plantings after installation.
   2. The Contractor shall be responsible for verifying grades and site conditions before beginning work. No change in Contract price will be owed for actual or claimed discrepancy between existing grade and those shown on the plan after Contractor has accepted existing grades and moved on the site.

B. Scheduling: Perform planting only when weather and soil conditions are suitable, as approved by Architect.

C. The irrigation system shall be operational and approved prior to planting.

D. Utilities: Prior to excavation for planting or installation of stakes or guys, Contractor shall locate utility lines and cables, so that proper precautions will be taken not to damage them. In the event of a conflict between utility lines and plant locations, promptly notify the Architect, who shall arrange for the relocation of one or the other. Failure to follow this procedure shall make the Contractor responsible for repairing damages at his own expense.

E. Waterproofing: Verify that waterproofing is complete and water-tight in over-structure planters.

3.2 SOIL PREPARATION:

A. Planting Areas:
   1. Uniformly spread amendments and thoroughly cultivate by means of mechanical tiller per Soils Report.
   2. Use nutrients recommended in the Soil Report.
   3. Add the appropriate Mycorrhizal inoculum and incorporate at manufacturer's recommended rate.
   4. Perform soil preparation after irrigation is installed and tested, and prior to planting.

B. Final Grades and Planting Area Layout:
   1. At time of planting, the top two (2) inches of areas to be planted or seeded shall be free of stones, sticks, stumps, or other deleterious matter one inch in diameter or larger. It shall also be free from wire, plaster, construction debris, or similar objects that would be a hindrance to planting or maintenance.
   2. Contractor shall be responsible for shaping planting areas as indicated on Plans or as directed by Architect.

3. Minor modifications to grade may be required to establish the final grade. Remove soil generated by excavations to an approved off-site location unless said soil can be utilized to obtain desired grade.
4. Finish grading shall insure proper drainage of the site as determined by the Architect.
5. Areas shall be graded so that the final grades will be 1-1/2" below adjacent paved areas, sidewalks, valve boxes, headers, cleanouts, drains, manholes, etc. or as indicated on Plans.
6. Surface drainage shall be away from building foundations.
7. Eliminate erosion scars prior to commencing maintenance period. Depressions due to settling shall be eliminated before and after planting.
8. Slopes of two to one (2:1) or steeper shall be protected with erosion control fabric. Contractor shall request clarification from Architect for fabric and methods.

C. Compacted Soil / Percolation Testing: Soil may be heavily compacted which can hinder root development, drainage and aeration.
1. Severely compacted areas shall be ripped or tilled to a depth of at least 9” prior to planting.
2. Percolation tests of water through the soil shall be performed where trees 24” box size and larger are proposed. If trees are to be planted over a large area, several percolation tests will be required.
a. Excavate two planting pits 24” deep by 2 times rootball diameter. Install sand filled drainage sump as specified in 3.3.D.4, below, in one of the pits.
b. Fill the pits with water and allow to drain completely.
c. Fill the pits with water a second time.
d. Results:
1) If the pit with no sump drains completely within 24 hours, no drain sump is necessary for trees planted within the vicinity of the test pit.
2) If the pit with no sump does not drain completely within 24 hours, but the pit with the sump does, sumps are required for trees planted in the vicinity of the test pit.
3) If the pit with the sump does not drain completely within 24 hours, advise the Owner prior to planting.

D. Pre-Plant weed Control:
1. “Grow & Kill”: If weeds exist on site at the beginning of work, spray with a non-selective systemic contact herbicide, recommended by an approved licensed landscape Pest Control Advisor and applied by a licensed Pest Control Operator. Leave sprayed plants intact to allow systemic kill as directed by Advisor. After recommended kill period, water thoroughly to encourage new weed growth, and re-apply systemic herbicide.
2. Treat planting areas, except for those to be seeded, with pre-emergent herbicide, recommended by an approved licensed landscape Pest Control Advisor and applied by a licensed Pest Control Operator
3. Maintain site weed free until final acceptance by Owner by utilizing mechanical, manual, or chemical treatment.

3.3 PLANTING

A. Planting Layout: Plant layout is to be approved by Architect before planting begins. Layout of trees and major plantings shall be approved first. One tree with each type of specified staking shall be approved prior to planting of trees. Bring conflicts regarding the exact locations of plant pits to the attention of Owner’s representative and Architect. If underground utility lines or other unknowns are encountered in excavation for planting, alternate locations for planting may be selected by the Architect. It is the Contractor's responsibility to verify with the Owner's superintendent and governing agencies the location and depth of underground utilities.

B. Planting of Trees and Shrubs (at grade):
   1. Do not plant rootbound, dried out, undersized, or damaged plants.
   2. Install trees, shrubs, and groundcovers before planting seed or sod.
   3. Excavated holes shall have vertical sides with roughened surfaces and shall be twice the diameter and the depth of the root b.
   4. Drainage: Drainage sumps are to be provided in each tree pit. Drain sumps (12-inch diameter by 6 feet deep) may be augured. Sump is to be filled with coarse sand. Planting may proceed after sump installation.
   5. Fill excavations with water and allow to percolate out, before positioning trees and shrubs.
   6. Install root control barriers where indicated on Plans and where site conditions (trees within three feet of pavement) dictate. Install per manufacturer's instructions.
   7. Center plant in pit or trench. Remove boxes and cans without damage to rootball. Add the appropriate Mycorrhizal inoculum next to rootball at manufacturer's recommended rate. Set plant plumb and hold rigidly in position until soil has been dampened firmly around b or roots. An earthen basin shall be constructed around each plant. Each basin shall be of a depth sufficient to hold at least two inches (2") of water. Remove basin in turf areas after initial watering. Plants that settle deeper than the surrounding grade shall be raised to surrounding grade level.

C. Planting Tablets: Place the following numbers of 7-gram planting tablets within the backfill of each plant:

Container size	Number of tablets
1 gallon	3
5 gallon	8
15 gallon	12
24" box	16
36" box	24
48" box	32

D. Staking and Guying: Staking and Guying of trees shall be completed immediately upon planting. Stakes shall be installed plumb and as indicated in details. Guy locations and methods shall be reviewed prior to planting of boxed trees. Bring conflicts of locating guys or stakes to the attention of Architect. Remove nursery stakes when site stakes have been installed.

E. Ground covers: Ground covers or seedlings shall be planted in straight rows and evenly spaced, unless otherwise noted, and at intervals called out in the drawing. Triangular spacing shall be used unless otherwise noted on the drawing. Fill in bare areas with plants at the required spacing. Damage to plants by trampling or other work in this contract shall be repaired immediately.

F. Sod Planting:
   1. Preparing Soil: Remove rocks or sticks from area to be sodded. Prepare soil as noted elsewhere in specifications and break up clods.
   2. Grading and Rolling: Carefully smooth surfaces to be sodded. Roll area in two directions to expose soil depressions or surface irregularities, then re-grade and re-roll soil as required producing a firm smooth surface. Be sure soil is level, smooth, and moist (not wet) before laying sod. Avoid laying sod on hot or extremely dry soil.
   3. Laying Sod: Lay first strip of sod slabs along a straight line (use a string in irregular areas). Butt joints tightly. Do not overlap edges. On second strip, stagger joints (as with laying brick). Use a sharp knife to cut sod in order to fit curves, edges, and sprinkler heads.
   4. Watering During Planting: Do not lay whole lawn before watering. When a large area has been sodded, water lightly to prevent drying. Continue to lay sod and water until installation is complete.

5. Rolling Sod: After laying sod, roll lightly to eliminate irregularities and to form good contact between sod and soil. Avoid heavy roller or excessive initial watering which may cause roller marks.
6. Irrigation: Water the completed lawn surface thoroughly. Soil should be moistened at least eight inches deep. Repeat sprinkling at regular intervals to keep sod moist until rooted. After sod is established, decrease frequency and increase amount of water per application as necessary.
7. Replacement: Replace dead or dying sod with equivalent material as directed by Architect.

G. Mulch covers:
1. Complete planting and finish grades before placing mulch.
2. Place mulch material in a continuous layer 3" deep adjacent to plant crown in shrub and groundcover areas, and in areas between shrubs.
3. Place mulch in a 2” deep layer in areas with flatted groundcover and annual color.
4. Install special mulches (glass, rock) over weed control fabric.
   a. Overlap fabric a minimum of 8”.

H. Install Arbor-gard tree trunk protector on trees planted in turf areas. Install per manufacturer's instructions.

3.4 CLEANUP

A. After planting operations have been completed, remove trash, excess soil, empty plant containers, and rubbish from the property, and dispose of legally.

B. Cleanup shall be performed at the end of each working day, with a maximum cleanup effort (in a manner satisfactory to the Owner) for each weekend or Holiday.

C. The Contractor shall sweep the site and shall wash down pavement within the Contract area, leaving the premises in a clean condition.

D. Walks shall be left in a clean and safe condition.

E. Scars, ruts, or other marks in the ground caused by this work shall be repaired and the ground left in a smooth condition throughout the site.

END OF SECTION 32 90 00

This page intentionally left blank.

SECTION 32 92 23 - SODDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Sodding of Lawn Areas.

B. Related Sections:
1. Section 32 01 90, Landscape Maintenance Period.
2. Section 32 84 00, Planting Irrigation.

1.2 REFERENCES

A. ASTM — ASTM International: D 1557 — Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.

1.3 DEFINITIONS

A. Acceptance, Acceptable, or Accepted: Acceptance by the Landscape Architect in writing.

B. Excessive Compaction: Planting area soil compaction greater than 75 percent maximum dry density as determined by ASTM D 1557.

C. Landscape Architect: Landscape Architect employed by the Owner to provide professional landscape architectural services for the Project.

1.4 SUBMITTALS

A. General Requirements: Refer to Division 1.

B. Product Data: Sod.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Provide for inspections and permits required by federal, state and local authorities in furnishing, transporting, and installing materials.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Harvest and Delivery of Sod:
1. Harvest from the source and deliver to project site within 24 hours.
2. Deliver only as much sod as can be installed within 24 hours after harvest.
3. Sod not transplanted within 24 hours after harvest will be rejected.

B. Storage and Protection: Protect sod which cannot immediately be laid by storing in shade and keeping it fresh with moistened burlap.

1.7 SEQUENCING AND SCHEDULING

A. Sodding: Install sod after the temporary certificate of occupancy has been granted.

1.8 WARRANTY

A. Warranty Period: Warrant that grasses shall be in a healthy and flourishing condition of active growth at the end of the next growing season after the date of Final Completion.

B. Condition: Free of dead or dying patches, and areas shall show foliage of normal density, size and color.

C. Delays: Delays in completion of planting operations which extend the planting into more than one planting season shall extend the Warranty period correspondingly.

D. Coverage: Warrant growth and coverage of sod to the effect that a minimum of 95 percent of the area sodded shall be covered with specified planting after one growing season with no bare spots greater than 1 square foot.

E. Replacement: As soon as weather conditions permit, resod, without additional cost to the Owner, areas of dead sod not in a vigorous, thriving condition, during and at the end of the Warranty Period.

F. Requirements for Replacements: Apply requirements of this Section to replacement Work.

1.9 MAINTENANCE

A. Maintenance Service: Refer to Section 32 01 90.

PART 2 - PRODUCTS

2.1 MATERIALS

A. PHC Turf Saver Fertilizer:
1. Mycorrhizal fungicide inoculant formulated for turf installation and maintenance.
2. Blend of mycorrhizal fungi and rhizosphere bacteria selected for beneficial activities in plants.
3. Colonize is a proprietary stimulant to increase colonization rates of grass roots.
4. Increases feeder root absorption capacity.
5. Prevents sod loss due to heat and drought stress.
6. Prevents root system decline.
7. Helps recover from stress and root damage.

B. Sod Type
1. Dark green in color, relatively free of thatch, free from diseases, weeds and harmful insects.
2. Reasonably free of objectionable grassy and broadleaf weeds. Sod will be considered weed free if no more than ten such weeds are found per hundred square feet of sod.
3. Free of Bermuda grass, quackgrass, johnsongrass, poison ivy, nimbleweed, thistle, bindweed, bentgrass, perennial sorrel, bromegrass.
4. Soil depth of 1/2-inch plus or minus 1/8-inch.
5. Strong enough that handling will not tear sod.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General: Examine site and verify that conditions are suitable to receive Work and that no defects or errors are present which would cause defective installation of products or cause latent defects in workmanship and function.

B. Finish Grade and Soil Preparation Verification: Verify finish grading and soil preparation Work is complete.

3.2 PREPARATION

A. Protection of Existing Conditions:
   1. Use adequate precautions to prevent damage to existing conditions to remain such as structures, utilities, plant materials and walks on or adjacent to the site of the Work.
   2. Use every possible precaution to prevent excessive compaction of planting area soil within or adjacent to the areas of Work.
   3. Provide barricades, fences or other barriers to protect existing conditions to remain from damage during construction.
   4. Do not store materials or equipment, permit burning, or operate or park equipment under the branches of existing plants to remain.
   5. Submit written notification of damaged plants and structures to the Owner's Designated Representative immediately.

B. Soil Surface Preparation: Prior to installing sod, manually remove and dispose of rocks and clods larger than 1/2-inch diameter from soil surface using rakes and apply 22 pounds of PHC Turf Saver per 1,000 square feet.

3.3 SODDING

A. Timing:
   1. Install sod within 24 hours of delivery.
   2. Sod not transplanted within 24 hours of delivery will be rejected.

B. Rolling Sod Bed:
   1. Roll amended soil in lawn areas with 200-pound water-ballast roller.
   2. Tamp surfaces of lawn joint planting soil mix firm, to level indicated on the Drawings.

C. Moistening Sod Bed: After unevenness in the soil surface has been corrected, lightly moisten the soil immediately prior to laying the sod.

D. Handling Sod:
   1. Handle sod gently enough to avoid stretching or tearing pieces.
   2. Carry sod pieces rolled or folded.
   3. Do not carry sod pieces by one end.

E. Laying Sod:
   1. Lay the first row of sod in a straight line, with subsequent rows parallel to and tightly against each other, with no spaces between strips.
   2. Stagger joints so none of the adjacent pieces align.
   3. Do not stretch or overlap sod.
   4. Butt joints tightly to eliminate gaps without stretching sod.
   5. Use a sharp knife to cut sod to fit angles and curves.

6. Avoid installing small sod strips at edges.
7. Water completed sections lightly during installation to keep moist before post installation irrigation of entire area.
8. Do not repeatedly walk or kneel directly on sod during installation to avoid indentations and air pockets.
9. When necessary to walk on sod during installation, lay down minimum 3/4-inch thick plywood to protect areas to be walked on.
10. Remove protection plywood as soon as possible to avoid smothering sod.

F. Tamping and Rolling Sod:
1. Thoroughly tamp and roll sod with a 200-pound water-ballast roller to make contact with sod bed.
2. Roll each entire section of completed sod.

G. Watering: Thoroughly water sod immediately after installation to wet the underside of the new sod pad and the soil immediately below to a depth of 6 inches.

3.4 PROTECTION

A. Sod Damage and Excessive Compaction:
1. Restrict vehicular and foot traffic from new sod for 4 weeks after installation.
2. After 4 weeks, do not allow equipment, vehicular, or foot traffic on sodded areas, except for lawn mowers and landscape maintenance personnel.

END OF SECTION 32 92 23

SECTION 331000 - SITE WATER UTILITIES

WATER SERVICE NOTE: WATER SERVICE MUST BE MAINTAINED TO ALL USERS WITHIN THE CONSTRUCTION AREA AT ALL TIMES. IF THE PRIMARY SOURCE OF WATER IS INTERRUPTED, A TEMPORARY SECONDARY SOURCE SHALL BE SUPPLIED BY THE CONTRACTOR, APPROVED BY THE LOCAL WATER DEPARTMENT. ANY EXPENDITURES INCIDENTAL THERETO SHALL BE BORNE BY THE CONTRACTOR. THE WATER SHALL BE SAFE FOR DRINKING IN ACCORDANCE WITH PUBLIC HEALTH SERVICE DRINKING WATER STANDARDS.

PART 1 - GENERAL

1.01 SUMMARY

A. This section describes general requirements, products, and methods of execution relating to domestic & fire water systems serving all buildings and appurtenances. Unless otherwise noted, this section does not apply to irrigation systems and water systems inside buildings and within 2 feet of buildings.

B. Contractor shall furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing and piping and including the demolition and removal of certain equipment, piping and appurtenances all as required and as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

C. Section Includes:

1. Piping and specialties for underground domestic water outside the buildings.

2. Trenching Requirements: Conform to the requirements of Section 31 20 00 – Earthwork.

3. Hydrostatic Pressure, Leakage & Disinfection Testing.

1.02 SUBMITTALS

A. Product Data: Manufacturer’s catalog data for materials. Include technical data for piping, gaskets, joints and couplings, gate valves and valve boxes, tracer wire, detectable warning tape, concrete thrust block mix design, fire department connections, wafer check valves, tapping sleeve, blue reflective marker and mechanical joint restraints.

B. Certificates: Certificates attesting that tests set forth in referenced publications have been performed and the performance requirements have been satisfied.

1.03 LICENSES, PERMITS & FEES

A. The Contractor installing the water lines shall have a Class “C-34”, “C-36” or Engineering “A” Contractors license valid in the State of California.

B. The Contractor shall obtain all necessary permits, licenses, or agreements required by any legally constituted agency, pay for all fees and give all necessary notices required for the construction of the work. The Owner shall reimburse the contractor for all necessary permits or inspection fees by any legally constituted agency.

1.04 QUALITY ASSURANCE

A. California Plumbing Code, CPC, 2016 Edition.

B. Comply with the following as a minimum requirement:

1. ANSI:

   a. ANSI B16.18 Cast Copper Alloy Solder Joint Pressure Fittings.

   b. ANSI B18.5.2.1M Metric Round Head Short Square Neck Bolts.

2. ASTM:

   a. ASTM A 47 Ferric Malleable Iron Castings.

   b. ASTM A 48 Gray Iron Castings.

   c. ASTM A 53 Pipe, Steel, Black and Hit-Dipped, Zinc-Coated Welded and Seamless.

   d. ASTM A 307 Carbon Steel bolts and Studs, 60,000 psi Tensile Strength.

   e. ASTM A 563 Ductile Iron Castings.

   f. ASTM A 563 Carbon and Alloy Steel Nuts.

   g. ASTM B 61 Steam or Valve Bronze Castings.

   h. ASTM B 62 Composition Bronze or Ounce Metal Castings.

   i. ASTM B 88 Seamless Copper Water Tube.

   j. ASTM C 94 Ready-Mixed Concrete.

   k. ASTM D 1527 Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe, Schedules 40 and 80.

   l. ASTM D 1785 Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80 and 120.

   m. ASTM D 2235 Solvent Cement for ABS Plastic Pipe, and Fittings.

   n. ASTM D 2241 PVC Plastic Pipe Fittings, Schedule 40.

   o. ASTM D 2282 ABS Plastic Pipe.

   p. ASTM D 2466 PVC Plastic Pipe Fittings, Schedule 40.

   q. ASTM D 2468 ABS Plastic Pipe Fittings, Schedule 40.

   r. ASTM D 2564 PVC Plastic Piping Systems.

   s. ASTM D 2774 Underground Installation of Thermoplastic Pressure Piping.

   t. ASTM D 2855 Making Solvent-Cemented Joints with PVC Pipe and Fittings.

   u. ASTM D 3139 Joints Pressure Pipes Using Flexible Elastomeric Seals.

   v. ASTM F 402 Safe Handling Of Solvent Cements, Primer and Cleaners Used for Joining Thermoplastic Pipes and Fittings.

w. ASTM F 477 Elastomeric Seals for Joining Plastic Pipes.

3. American Water Works Association (AWWA) Standards:

a. AWWA C104/A21.4 Cement-Mortar Lining For Ductile-Iron Pipe and Fittings For Water

b. AWWA C110/A21.10 Ductile-Iron and Gray-Iron Fittings, 3 inches through 48 inches, for Water and Other Liquids.

c. AWWA C111/A21.11 Rubber-Gasket Joints for Ductile-Iron pressure Pipe and Fittings.

d. ASTM C151/A21.51-96 Ductile-Iron Pipe, centrifugally cast, for water 3 inches through 64 inches.

e. AWWA C153/A21.53 Ductile-Iron Compact Fittings, 3 inches through 16 inches, for Water and Other Liquids.

f. AWWA C500 Gate Valves for Water and Sewerage Systems.

g. AWWA C503 Wet- Barrel Fire Hydrants.

h. AWWA C508 Swing-Check Valves for Waterworks Service, 2 inches through 24 inches NPS.

i. AWWA C509 Resilient-Seated Gate Valves for Water and Sewerage Systems.

j. AWWA C511 Reduced-Pressure Principal Backflow-Prevention Assembly.

k. AWWA C600 Installation of Ductile-Iron Water Mains and Their Appurtenances.

l. AWWA C651 Disinfecting Water Mains.

m. AWWA C800 Underground Service Line valves and Fittings.

n. AWWA C900 PVC Pressure Pipe, 4 inches through 12 inches, for Water Distribution.

o. AWWA M23 PVC Pipe - Design and Installation.

4. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry:

a. MSS-SP-80 Bronze Gate, Globe, Angle and Check Valves.

b. MSS-SP-73 Silver Brazing Joints for Wrought and Cast Solder-Joint Fittings.

5. Uni-Bell PVC Pipe Association (UBPPA):

a. UBPPA UNI-PUB-9 Installation of PVC Pressure Pipe.

b. UBPPA UNI-B-13 Standard Performance Specification on joined restrained devices for use with Poly Vinyl Chloride (PVC) Pipe.

1.05 SEQUENCING AND SCHEDULING

A. Coordinate with other utility work.

1.06 PRODUCT HANDLING

A. Store items above ground on platforms, skids or other approved supports.

B. Deliver piping with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

C. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

D. Handling: Use sling to handle valves and fire hydrants whose size requires handling by crane or lift. Rig valves to avoid damage to exposed valve parts. Do not use hand wheels or stems as lifting or rigging pongs.

E. Protect coating and linings on pipes, fittings and accessories from damage. Do not drag pipe to trench. Repair coatings or linings damaged.

1.07 DISPOSAL OF REMOVED MATERIALS INCLUDING ASBESTOS-CEMENT PIPE

A. All removed materials, except those indicated on the plans or described herein to remain the property of the Owner, shall become the property of the Contractor and shall be disposed in accordance with local, state, and federal laws. Should any of those materials be considered as hazardous the Contractor shall provide the Owners Inspector with paper custody trail documentation of the disposal.

B. Asbestos – Cement (A-C) Pipe Removal and Disposal: The plans for the project may indicate that existing asbestos-cement pipe is to be removed from the ground. Where so indicated the Contractor shall excavate as specified in 312200, expose the pipeline and remove the A-C pipe to the nearest joint. Should the plans not call out the removal of the A-C pipe and A-C pipe is encountered, the Contractor shall obtain approval from the Inspector as to whether or not the A-C pipe is to be removed or can be left in place. Cutting of the pipe shall only be done if absolutely there is no other way to expose the length of pipe to the nearest joint that be separated and the Inspector approves the cutting of the pipe. Cutting of the pipe shall be done with a mechanical saw with a pressure water source to dampen the pipe and the dust from the cutting. To remove a coupling, the coupling may have to be broken in the trench. The pipe once removed from the trench may be broken for handling. The breaking shall be done within a plastic bagging or sheeting material to minimize the release of asbestos fibers into the atmosphere. Once removed and broken, if necessary, the A-C material shall be bagged and disposed of legally with the Inspector to be given a copy of all Contractor paperwork as to the legal disposal of the material. If the A-C pipe section(s) are removed intact the pipe can be removed by the Contractor from the project site and become the property and responsibility of the Contractor.

1.08 DRAWINGS

A. Because of the small scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, and other devices which may be required to complete the installation.

B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his acceptance. Only when Architect's acceptance is given, in writing, shall Contractor proceed with installation of the work.

C. In case of a difference in the specifications or drawings, or between the specifications and the drawings or in the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.09 EXAMINATION OF PREMISES

A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.10 PROTECTION

A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.11 LOCATIONS

A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.

B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid confliction and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.

1.12 SUBMITTAL DATA

A. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to put identification numbers on fixtures and equipment schedules.

B. Manufacturer’s submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.

C. Submittals will be checked for general conformance with the design concept of the project but the review does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.

D. A list of names is not a valid submittal. To be valid, all submittals must:

1. Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.

2. Include all pertinent construction, installation, performance and technical data.

3. Have all copies marked to indicate clearly the individual items being submitted.

4. Have each item cross-referenced to the corresponding specified item and be marked to show how differences will be accommodated.

5. Contain calculations and other detailed data justifying how the item was selected for proposal. Data must be completed enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.

6. Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

7. In addition to the material and equipment submittals, the Contractor shall provide shop drawings of all underground utilities complete with all appurtenances and indicate exact location by dimension to grading plan, submit for review prior to installation.

1.13 INSPECTION

A. Notice shall be given to the Owner’s Inspector at least 48 hours before starting construction.

B. Contractor shall not allow or cause any of his work to be covered up before it has been duly inspected, tested and approved by the Owner, Architect or any other authorized inspectors having legal jurisdiction over his work. Should he fail to observe the above, he shall uncover the work and, after it has been inspected, tested and approved, recover it at his own expense.

C. Inspection of the work shall not relieve the contractor of any obligations to complete the work as prescribed by the standard specifications. Any known defective work shall be corrected before testing or final inspection will be permitted. Unsuitable materials may be rejected even if these materials have been previously overlooked by the Inspector.

D. The Owner shall have the authority to suspend the work completely or in part for such time as it may deem necessary if the contractor fails to carry out instructions given by the Owner, or to perform any required provisions of the plans and specifications. The contractor shall immediately comply with a written order of the Owner to suspend the work completely or in part. The work shall be resumed when improper methods or defective work are corrected as ordered and approved in writing by the Owner.

1.14 SUBSTITUTIONS

A. The Contractor assumes full responsibility that alternate manufacturers, items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures which ensure that the

Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates were selected without proper regard to the requirements of the job, will not be approved. No more than one proposed alternate will be considered for each item.

B. This Contractor is responsible to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.

C. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials and decisions of the Architect or that of his representative shall be final and conclusive.

1.15 RECORD DRAWINGS

A. Contractor shall provide and keep up-to-date a complete "as-built" record set of redline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Pipe:

1. Water Distribution Main (pipe size 4 inches and larger).

a. Ductile Iron Pipe (DIP): Pressure Class 350 pipe conforming to AWWA/ANSI C151/A21.5, cement-mortar lining conforming to AWWA/ANSI C104/A21.4, with standard thickness per AWWA/ANSI C150/A21.50. U.S. Pipe, American Cast Iron Pipe Company (ACIPCO), or approved equivalent.

b. Polyvinyl Chloride Pipe (PVC): Pressure Class 235, DR 18, spigot and gasket bell end, conforming to AWWA C900, with equivalent cast-iron pipe outer diameter (O.D.). Acceptable manufacturers: J-M Manufacturing Blue Brute, Vinyl Tech, Diamond Plastic, PW Pipe, or approved equal.

2. Domestic Water Pipe Schedule 80 PVC: Poly Vinyl Chloride (PVC) Plastic Pipe, Schedule 80, meeting ASTM D 1785 standards.

B. Fittings:

1. Domestic Water Pipe Poly Vinyl Chloride (PVC) Water fittings shall conform to ASTM D 2467 “Socket-Type” PVC Plastic Type Fittings, Schedule 80.

2. All fittings for Iron Pipe Size pipe shall be manufactured in one piece of injection molded PVC compound meeting ASTM D1784. Fittings shall be Class 315 and conform to requirements of SDR 13.5. Fittings shall be designed to withstand a minimum of 630 psi quick burst pressure at 73 degrees F., tested in accordance with ASTM D1599.

3. Ductile Iron: Ductile iron fittings shall be supplied in accordance with AWWA Standard C110, Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. for Water and Other Liquids”, or AWWA Standard C153, “Ductile Iron Compact Fittings, 3 In. Through 24 In for Water

Service". All fittings shall have mechanical joints unless otherwise specified on Construction Plans.

a. Mechanical joints shall conform to the requirements of AWWA Standard C111, "Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings."

b. Flanged fittings shall conform to the requirements of AWWA Standard C110 or C153. Flanges shall be drilled to ANSI B16.1, 125 lb standard bolt template. The 250 lb. Flanges, when required, shall be drilled to ANSI B16.1, 250 lb. standard bolt template.

c. Where restrained joints are indicated on the plans, push-on "Tyton" joints shall be restrained with "Field-Lok" gaskets as manufactured by U.S. Pipe or approved equal.

d. Ductile iron pipe fittings shall be manufactured or supplied by American Ductile Iron Pipe (a division of American Cast Iron Pipe Company, Birmingham, Alabama), U.S. Pipe & Foundry Company, Tyler Pipe/Union Foundry, Griffin Pipe Products Company, Sigma Corporation, Star Pipe Products Co., or approved equal.

C. Gaskets for Ductile Iron Pipe:

1. Gaskets for Ductile Iron Pipe: Gaskets for flanged joints shall be full faced, cut from 1/8 inch thick Nitrile Rubber (Buna-N), bolt holes pre-punched, conforming to the requirements of ANSI /ASME B16.2.1. Gaskets shall be manufactured or supplied by Tripac Fasteners, Long Beach Industrial Gaskets, or approved equal.

D. PVC & Mechanical Pipe Couplings, Joints and Jointing Materials:

1. Pipe joints on plastic pipe 3-inch and under shall be solvent cement joints conforming to ASTM D 2564, primer according to ASTM F 656. Solvent and primer shall not be more than one year old.

2. All couplings shall be manufactured from the same materials and in compliance with the specifications set forth herein before for PVC pipe.

3. PVC C-900 Pipe: joints shall be integral, bell and spigot gasketed joints.

a. Provide each PVC C-900 Pipe joint connection with an elastomeric gasket suitable for the bell or coupling installation.

b. An elastomeric gasket shall be designed with a retainer ring which "locks" the gasket into integral bell groove and shall be installed at the point of manufacturer. Gasket shall be in conformance with ASTM F477.

c. Gaskets for push on joints and compression type joints or mechanical joints for connections between pipes and metal fittings, valves, and other accessories shall be as specified in AWWA C111/A21.11.

d. Solvent weld joints are NOT PERMITTED.

4. Joints between pipe and metal fittings, valves, and other accessories shall be mechanical joints as specified in AWWA C111/A21.11 unless otherwise noted on Construction Documents.

E. Lining and Coating for Ductile Iron & Fittings:

1. The interior of all ductile iron pipe and fittings shall be factory cement mortar lined in accordance with AWWA Standard C104. Lining materials shall conform to ASTM C-150, Type II.

2. All buried ductile iron pipe and fittings shall have a factory applied bituminous coating of not less than 1 mil in thickness as specified in AWWA C151. The coating shall be free from blisters and holes; shall adhere to the metal surface at ambient temperatures encountered in the field.

3. Cement mortar lining and bituminous coating of pipe or fittings in the field is not permitted.

F. Bolts and Nuts for Mechanical Joints, Flanged Fittings, Flexible Couplings & Restraint Devices:

1. All bolts and studs shall be Type 316 Stainless Steel per ASTM A193 Grade B8M, project ends of bolts ¼ to 3/8 inch beyond nut.

2. All nuts and washers shall be Type 316 Stainless Steel per ASTM A194 Grade 8M, provide 1 washer per nut.

3. All exposed flanges and other metal surfaces and all damaged coatings shall be coated after assembly with a mastic, Minnesota Mining and Manufacturing EC 244, Koppers Bitumastic (Super-Tank) 505, or an approved equal.

4. Stainless steel parts shall not be coated except for the threaded portion, which will be assembled with a liberal coat of anti-seize compound.

5. All bolts shall be lubricated with anti-seize compound.

G. Valve Boxes, Risers and Lids for Buried Valves:

1. Valve boxes and cover shall be as shown on Construction Documents.

2. Valve riser material, where applicable, shall be 10-inch Schedule 80 PVC, or 10-inch SDR 35 PVC pipe

3. Paint domestic water valve box lids with 2 coats of blue enamel and fire water valve box lids with 2 coats of red enamel.

4. Valve boxes shall be marked “WATER” embossed above surface.

H. Thrust Restraining Materials: All pipe bends and tees 2.5-inches and greater shall be restrained from movement by either the use of concrete thrust blocks or mechanical joint restraints. Restraint systems to be used on PVC C-900 pipe shall meet or exceed A.S.T.M. Standard F1674-96, “Standard Test Methods for Joint Restraint Products for Use with PVC Pipe,” or the latest revision thereof. Restraint systems used on ductile pipe shall meet or exceed U.L. Standard 194. Underwriter Laboratories (U.L.) and/or Factory Mutual (FM) certifications are required on all restraint systems. All mechanical restraint devices shall be wrapped with 3 layers of 8-mil polyethylene after assembly.

1. Mechanical Joint Fittings:

a. Restrainer mechanism shall be integrated into the design of the follower gland. As the mechanism is activated, multiple wedging action shall be imparted against the pipe increasing its resistance as internal pressure increases. After burial of the restraining mechanism, joint flexibility shall be maintained. The actuating bolt shall be threaded into the restraining wedge and have a 1-1/4" across the flats hex head.

The actuating bolt system shall have a torque-limiting head designed to break off at preset torque levels, thus insuring proper action of the restraining device. After removal of the torque-limiting head, a 1 1/4" hex head shall remain to facilitate the removal and re-assembly of the gland. Glands shall be manufactured of high strength ductile iron in accordance with ASTM A536, Grade 65-45-12 requirements. Wedge mechanisms shall be heat-treated ductile iron, hardened to at least 370 BHN hardness. The restraining mechanism shall have a pressure rating equal to that of the pipe on which it is used and shall have a safety factor of at least 2:1. The restraining gland shall conform to the requirements of ASTM F 1674, and UNI-B-13-94, "Recommended Performance Specification For Joint Restraint Devices For Use With Polyvinyl Chloride (PVC) Pipe."

b. The following qualified product list identifies specified manufacturers models approved for installation in this water distribution system:

Manufacturer	PVC C-900 Pipe	Ductile Iron Pipe
EBBA Iron Sales, In	2000 PV	Megalug 1100
Romac Industries, In	Romagrip PVC	Romagrip DI
Star Pipe Products	Stargrip 4000	Stargrip 3000
Uni-Flange Corporation	Series 1500	Series 1400

2. Bell and Spigot Harness:

a. Restraint Devices for bell and spigot joints of PVC Pipe shall consist of split restraint rings, one installed on the spigot, connected to one installed on the pipe barrel behind the bell. The restraint devices shall incorporate a series of machined serrations (not "as cast") on the inside diameter to provide positive restraint, exact fit, 360° contact and support of the pipe wall. Restraint Devices shall be of ductile iron, ASTM A536, Grade 65-45-12 and connecting rods shall be of high strength, low alloy material in accordance with ANSI / AWWA C111/A21.11 unless specified as stainless steel in these specifications.

b. All Restraint Devices shall have a water working pressure rating equivalent to the full rated pressure of the PVC Pipe they are installed on, with a minimum 2:1 safety factor in any nominal pipe size. In addition, they shall meet or exceed the requirements of Uni-B-13-94, "Recommended Performance Specification For Joint Restraint Devices For Use With Polyvinyl Chloride (PVC) Pipe." Notarized certification from the manufacturer of the restraint device shall be provided with submittals.

c. The following qualified product list identifies specified manufacturers models approved for installation in this water distribution system:

Manufacturer	PVC C-900 Pipe	Ductile Iron Pipe
EBBA Iron Sales, In	1600 Series	1700 Series
Romac Industries, In	611 Series	611 Series
Star Pipe Products	1100 Series	Not Approved
Uni-Flange Corporation	Series 1390	Not Approved

3. Push-On Pipe Bells & Plain End Pipe: Where restrained joints are indicated on the Construction Drawings for ductile iron pipe, push-on joints shall be restrained with "Field-Lok 350" gaskets as manufactured by U.S. Pipe or approved equal. "TR-Flex" restrained joint

pipe as manufactured by U.S. Pipe or approved equal is also an acceptable option for restrain of push-on joints. Restrained push-on joint pipe and fittings shall be capable of being deflected after assembly.

4. Flange Adapters:

   a. Flange Adapters shall be manufactured from ductile iron per ASTM A536, Grade 65-42-12 and shall have bolt circles and bolt holes to meet ANSI B16.1 – Class 125 or Class 250 if required and shown on plans.

   b. The following qualified product list identifies specified manufacturers models approved for installation in this water distribution system:

Manufacturer	PVC C-900 Pipe	Ductile Iron Pipe
EBBA Iron Sales, In	2100 Series	2100 Series
Romac Industries, In	Not Approved	Field Flange
Star Pipe Products	Not Approved	Series 200
Uni-Flange Corporation	Not Approved	Series 200/400/420

5. Concrete: Concrete for thrust blocks shall conform to Concrete Class 520-C-2500. If thrust block is to be disturbed or backfill is to be placed prior to developing its required strength, additional mechanical thrust restraining devices approved by the Civil Engineer shall be installed.

I. Tracer Wire for Nonmetallic Pipes: Tracer wires shall be electrically continuous #14 soft drawn copper wire, Type TW, blue plastic covered for potable water and red for fire water. Provide in sufficient length to be continuous over each installed section of nonmetallic pipe.

J. Polyethylene Encasement Film Wrap: All ductile iron pipe and fittings buried underground shall be protected with double wrapped plastic film in accordance with AWWA C105 "American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems" and each wrap shall be a minimum thickness of 0.008 in. (8 mils). All joints between plastic tubes shall be taped and secured with general purpose polyethylene tape, 2 inches wide and 10 mils thick (Scotchrap No. 50, Plicoflex No. 340, Protecto Wrap No. 200, Polyken No. 900, or approved equal).

K. Sleeve-type Flexible Transition & Flanged Couplings:

1. Sleeve-type couplings shall be in accordance with ANSI/AWWA C219 - Standard for Bolted Sleeve-type couplings for Plain-End Pipe, and shall be of stainless steel or ductile iron with stainless steel bolts, without pipe stop, and be of sizes to fit the pipe and fittings indicated. The middle ring shall be not less than 1/4-inch in thickness and shall be either 5 of 7 inches long for sizes up to and including 30 inches and 12 inches long for sizes greater than 30 inches, for standard steel couplings, and 16 inches long for long-sleeve couplings. The followers shall be single-piece contoured mill sections welded and cold-expanded as required for the middle rings, and of sufficient strength to accommodate the number of bolts necessary to obtain adequate gasket pressures without excessive rolling. The shape of the follower shall be of such design as to provide positive confinement of the gasket.

2. Gaskets for sleeve-type couplings shall be rubber-compound material that will not deteriorate from age or exposure to air under normal storage or use conditions. Gaskets for wastewater and sewerage applications shall be Buna "N," Grade 60, or equivalent suitable elastomer.

3. The gaskets shall be immune to attack by impurities normally found in water or wastewater. All gaskets shall meet the requirements of ASTM D2000 - Classification System for Rubber

Products in Automotive applications, AA709Z, meeting Suffix B13 Grade 3. All gaskets shall be compatible with the piping service and fluid utilized.

4. Bolts, nuts, & washers for couplings shall meet the requirements listed in Section 2.1K, herein. All cast components shall be fusion bonded epoxy coated per AWWA C213. After installation couplings shall be wrapped with 8-mil polyethylene wrap per AWWA C-105 and section 2.1M requirements listed herein.

5. Where insulating couplings are required, both ends of the coupling shall have a wedge-shaped gasket, which assembles over a rubber sleeve of an insulating compound in order to obtain insulation of all coupling metal parts from the pipe.

6. All sleeve-type couplings on pressure lines shall be harnessed unless thrust restraint is provided by other means. Harnesses shall be in accordance with the AWWA M11 standard, or as indicated.

7. The following qualified product list identifies specified manufacturers models approved for:

Straight & Transition Couplings

Romac Industries, Inc.:	Style “501”
Ford Meter Box Co.:	Style “FC1” or “FC2A”
Smith-Blair:	400 Series
JCM Industries:	200 Series
Dresser	Style 62 or 162

Flanged Coupling Adapters

Romac Industries, Inc.:	Style “FCA 501” or “FC400”
Ford Meter Box Co.:	Style “FFCA”
JCM Industries:	300 Series
Smith-Blair:	Style “913”
Dresser	Style 227

L. AWWA, Cast-Iron Gate Valves:

1. Manufacturers:

a. American Cast Iron Pipe Co.; American Flow Control Div.

b. American AVK.

c. Grinnell Corporation; Mueller Co.; Water Products Div.

d. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).

e. McWane, Inc.; Kennedy Valve Div.

f. McWane, Inc.; M&H Valve Company Division

g. United States Pipe and Foundry Company.

h. Or equal.

2. Non-rising-Stem, Resilient-Wedge Gate Valves: AWWA C509, ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut. Valves shall be full wall thickness whether using cast iron or ductile iron. The wall thickness reductions allowed by AWWA C515 shall not be used on University Projects.

   a. Rated Operating Pressure: 250 psig.

   b. Test Pressure : 500psig

   c. End Connections: Mechanical joint or flanged.

   d. Interior and exterior coating: Fusion-bonded, epoxy coated. Comply with ANS/AWWA C550, standard for Protective Interior Coating of hydrants and valves.

   e. Body to Bonnet bolts: Stainless steel 18-8

   f. Body Tapping Plug: **Do not** provide valves with accessory threaded plug.

   g. Stem shall have an integral thrust collar. Two-piece assemblies shall not be provided.

   h. Grate shall be fully encapsulated in EPDM or SBR. Gate shall have Delrin or other anti-friction insert (s) to reduce operating torque.

   i. Valves in buried service shall have a 2 inch square operating nut.

M. Tapping Sleeve

1. Tapping-Sleeve Assemblies: Comply with MSS SP-60. Include sleeve and valve compatible with drilling machine. Where line-stopping or other activity that is similar to tapping occurs, the same requirements for tapping sleeves shall be followed.

2. Manufacturers:

   a. Mueller Co.; Water Products Div.

   b. JCM Industries.

3. Tapping Sleeve: Cast- or ductile-iron or stainless steel, mechanical joint tapping sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve. The tapping sleeve shall provide a mechanical joint fitting at each end so that a failure of the pipe being tapped will not cause a leak. Unless it has positively been determined that the pipe to be tapped is not ACP, the sleeve shall be compatible for use with ACP.

   a. JCM Industries No. 414 mechanical joint tapping sleeve with fusion-bonded epoxy coating interior and exterior.

   b. Mueller Co.; H-615 or H-619 mechanical joint tapping sleeve with fusion- bonded epoxy coating interior and exterior.

4. Valve: AWWA, C509 cast-iron, fusion-bonded, epoxy coated. Non-rising-stem, resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.

N. Blue Reflective Pavement Markers

1. One (1) two-way blue reflective fire hydrant raised pavement marker shall be installed adjacent to each hydrant and existing blue reflective pavement marker removed (when present). Reflective markers, adhesives, and method of installation shall conform to the following caltrans standard specification:

Section 85-1.02c	retroreflective pavement markers
Section 85-1.02d	hot melt bituminous adhesive
Section 85-1.02e	epoxy adhesive
Section 85-1.03b	hot melt bituminous adhesive
Section 85-1.03c	epoxy adhesive

O. Check Valve:

1. UL-Listed & FM approved, ASTM A 126 Class B cast-iron body and bolted bonnet with flanged end connections; bronze disc and seat; and having 200 psig rating.

   a. Approved models: "Nibco" Model F-908-W or "Clow Valve Company" Style 106.

2. Paint one coat Dunn Edwards Versaprime 42-44 and two coats Dunn Edwards 71007 Safety Red. Apply paint after all testing and disinfection has passed, but prior to final acceptance by the Owner.

P. Fire Department Connections (FDC): Provide FDC's with 2-1/2 inch female hose connections, sidewalk or free-standing type. Number of inlets shall be as shown on the Construction Documents. Clapper and spring check inlets shall each have a minimum capacity of 250 gpm, and be furnished with a cap and chain. Outlet shall be sized for simultaneous use of all inlets. Connection shall be branded "Building XX"

1. 2-Way FDC: Connection shall conform to UL 405 or FM 1530. Elkhart, Croker, Potter-Roemer or approved equivalent.

2. 3-Way FDC: Connection shall be subject to approval by the local water department or fire marshal. Elkhart, Croker, Potter-Roemer or approved equivalent.

3. 4-Way FDC: Connection shall conform to UL 405. Potter-Roemer, Croker, or approved equivalent.

4. Paint one coat Dunn Edwards Versaprime 42-44 and two coats Dunn Edwards 71007 Safety Red. Apply paint after all testing and disinfection has passed, but prior to final acceptance by the Utility or Inspector.

PART 3 - EXECUTION

3.01 CLEARANCES OF WATER LINE

A. Buildings: 3 feet.

B. Parallel to Sewer Line:

1. Water lines 4 inches or less in diameter shall not be installed in a common trench with the building sanitary drain unless the bottom of the water line is at least 12 inches above the top of the building sanitary drain or where the water line is installed on a solid shelf excavated on one side of the common trench with a minimum clear horizontal distance of 12 inches from the building sanitary drain.

2. Water mains larger than 4 inches in diameter shall be separated from the Project site sanitary sewer, receiving more than one building sanitary drain or acid pipeline, in accordance with the requirement of the State of California, Human and Welfare Agency, Department of Health Services.

C. Crossing Sewer Line:

1. A water main shall be separated from sanitary sewer in accordance with the requirements of the State of California Administrative Code, Title 22, Section 64630(e)(2), unless modified herein.

2. Install water main a minimum of 12 inches clear, above or below a sanitary sewer.

3. A water main greater than 4 inches in diameter, crossing under a sanitary sewer line, shall be installed with all their joints located at least 10 feet away from each side of the sanitary sewer line.

4. A water main greater than 4 inches in diameter, crossing over a sanitary sewer line, shall be installed with all their joints located at least 5 feet away from each side of the sanitary sewer line.

D. Install all water mains no closer than 10 feet horizontally clear from the edge of sewage leach fields, seepage pits and septic tanks.

3.02 LAYING OF PVC PRESSURE PIPE

A. Installations of pipe, bends, and fittings shall be in accordance with Section 3.3 for ductile iron bends and fittings and AWWA C-605, “Underground Installation of (PVC) Pressure Pipe and Fittings for Water” and/or the Uni-bell guideline UNI-PUB-9, “Installation Guide for PVC Pressure Pipe”. PVC bends and fittings are not allowed. The Uni-Bell Handbook of PVC Pipe-Design and Construction shall be used for details of pipe installation practice except as follows and where noted otherwise on plans. Longitudinal bending of pipe sections is prohibited. Any directional change shall be accomplished through manufacturer approved 1 degree deflection of push on joints, 5 degree deflection with Certainteed – couplings, or ductile iron bends capable of withstanding 250 psi loads. A number 14 gauge, solid, soft drawn insulated copper tracer wire is required for PVC pipe installation. The tracer wire shall be wrapped around the pipe at 10-foot intervals and brought up inside each valve can to within 6 inches of the valve cover.

B. Acceptable line and grade for piping: The pipe shall be laid true to the line and grade shown on the plans within acceptable tolerances. The tolerance on grade is 1 inch. The tolerance on line is 2 inches.

C. A number 14 gauge, solid, soft drawn insulated copper tracer wire is required for PVC pipe installation on lines 2” and greater. The tracer wire shall be wrapped around the pipe at 10-foot intervals and brought up inside each valve can to within 6 inches of the valve cover.

D. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the trench. If the pipe-laying crew cannot put the pipe into the trench and in place without getting soil into it, the Engineer may require that before lowering the pipe into the trench, a temporary plug be placed over each end and left there until the connection is to be made to the adjacent pipe. During the laying operations, no debris, tools, clothing or other materials shall be left in the pipe.

E. At times when pipe laying is not in progress, the open ends of pipe shall be closed by watertight plug or other means approved by the Inspector. This provision shall apply during the lunch-hour breaks as

well as overnight. If water is in the trench, the seal shall remain in place until the trench is pumped completely dry.

F. The cutting of pipe for inserting tees, fittings or closure pieces shall be done in a neat workmanlike manner without damage to the pipe or cement lining and so as to leave a smooth end at right angles to the axis of the pipe. The beveled end of any PVC pipe shall be cut off before the pipe is inserted into a mechanical joint bend or fitting. No pipe shall be laid in water or when, in the opinion of the Engineer, trench conditions are unsuitable.

G. Should structural difficulties or Work of other trades prevent the running of pipes or the setting of equipment as indicated by Drawings, the necessary deviation will be allowed by the Owner's Inspector.

H. All water piping shall be adequately supported. Burred ends shall be reamed to the full bore of the pipe or tube. Change in direction shall be made by the appropriate use of fittings. All piping, equipment, appurtenances and devices shall be installed in conformity with the provisions and intent of the California Plumbing Code.

I. Install piping under streets and other obstructions that cannot be disturbed, by tunneling, jacking, or combination of both.

J. When connecting plastic pipe to copper, brass, or steel material, provide a schedule 80 PVC nipple.

K. Cure welded joints at least 15 minutes before moving or handling, and at least 24 hours before applying pressure to system, unless otherwise recommended by joint solvent manufacturer.

L. Field inspection for plastic pipe and fittings shall follow section 306-1.2.12, Standard Specifications for Public Works Construction, latest edition.

3.03 CONNECTIONS TO EXISTING UTILITIES

A. All tie-in locations shall be excavated a minimum of TWO (2) working days in advance of final connection to expose the affected portions of existing pipelines and to allow time for the necessary measurements, assembling of materials and equipment, and assuring that all pre-assembled piping and fittings will be compatible with the existing main.

B. Changes or delays caused by the Contractor's failure to perform "Potholing" and interference location work shall not be eligible for extra work, compensation, or time extension.

C. The Contractor shall immediately notify the Owner's Inspector in writing, upon learning of the existence or location of any utility facility omitted from or shown incorrectly on the contract drawings, or improperly marked or otherwise indicated. The Contractor shall provide full details as to depth, location, size and function of the utility in writing to the IOR and note it on the "as-built" plans.

D. The Contractor shall furnish and place the necessary protection around a utility when protection is called for on the contract drawings, visible to the Contractor, or marked as such. The Contractor shall install the utility protection at no additional expense to the Owner.

3.04 VALVES

A. Water valves shall be installed at locations shown on the Construction Drawing, or as directed by the Inspector. Valves shall be set plumb, and shall be stabilized and supported separately from the pipeline. Information regarding size, type, make, and number of turns to close shall be supplied to the Utility. All valves shall be covered with a valve box assembly. Valve boxes shall be plumb, centered over the valve nut, and supported separately from the valve body. Valve boxes shall be lowered to

below paving grade level prior to street paving, and after final grade has been established by the final grade. In any event, Contractor shall ensure that all valve boxes will provide access to the operation of the valve by the Utilities' personnel. Valve boxes shall be flagged or barricaded during construction to divert traffic around their location.

B. Wrap buried valves, 2-½ inches and larger, with two layers of 8-mil polyethylene wrap per AWWA C105.

C. All exposed flanges and other metal surfaces and all damaged coatings shall be coated after assembly with a mastic, Minnesota Mining and Manufacturing EC 244, Koppers Bitumastic (Super-Tank) 505, or an approved equal.

D. Stainless steel parts shall not be coated except for the threaded portion, which will be assembled with a liberal coat of anti-seize compound.

3.05 PROTECTION OF METAL SURFACES

A. All exposed surfaces of the valves, flanges, bolts, nuts, tie-rods, turn buckles, etc. in contact with the earth and backfill materials shall be coated with a minimum of 30 mils of bitumastic coating prior to backfilling. In addition to this bitumastic coating, all iron or steel surfaces such as valves, flanges, bolts, nuts, couplings, shall be encased in 8 mil polyethylene wrapping in accordance with AWWA C105 "American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems".

3.06 ELECTROLYSIS PREVENTION

A. Insulating (dielectric) couplings or 6-inch long brass nipples shall be installed at locations specified or as required. Dielectric insulators shall be provided to insulate dissimilar metal to metal contact. Flanges shall be provided with a complete insulating component consisting of gasket bolt sleeves and bolt washers. Dielectric insulators shall be installed at locations indicated or as required.

B. Where steel or cast iron below grade connects to copper or brass piping above grade, the transition from steel or cast iron pipe to copper or brass pipe shall be installed in an above grade accessible location.

C. Underground dielectric connections shall be in accessible yard boxes.

D. Above ground dielectric connections shall be exposed.

3.07 PIPELINE FLUSHING & HYDROSTATIC TESTING

A. General Requirements

1. Hydrostatic testing and disinfecting (chlorination and flushing) of newly laid or repaired pipelines and appurtenances must be completed before the pipelines can be connected to the existing water distribution system. Pipelines and appurtenances shall remain isolated from the existing water distribution system during hydrostatic testing and disinfecting.

2. All services, air release valves, and other appurtenances connected to the newly laid pipeline shall be pressure tested and disinfected at the same time as that of the pipeline. Care shall be taken to expel all air from the pipeline and services during any filling operation.

B. Temporary Piping and Appurtenances for Flushing, Testing, and Disinfecting

1. The Contractor and/or subcontractor shall supply all temporary piping, corporation and curb stops, test plates, bulkheads, plugs, pipe end caps, valves, fittings, calibrated meters,

equipment, labor and method necessary for pressure testing, chlorinating, and flushing of the newly laid pipeline. The Contractor shall also provide any temporary piping, backflow devices, and appurtenances needed to carry potable water to the section of pipeline being flushed, pressure tested, or disinfected.

2. Corporation and curb stop taps used for flushing, pressure testing, and disinfecting shall comply with service tap requirements for ductile iron pipe. Unless specified otherwise, the tap shall be made at the top of pipe.

C. Private fire service mains and lead-in connections to system risers shall be flushed thoroughly before connection is made to building system piping in order to remove foreign materials that might have entered the main during the course of the installation or that might have been present in existing piping. The minimum rate of flow shall be not less than the water demand rate of the system, which is determined by the system design, or not less than that necessary to provide a velocity of 10 ft/s, whichever is greater. For all systems, the flushing operations shall be continued for a sufficient time to ensure thorough cleaning. The General Contractor & Owner's Inspector shall be present during the flushing.

D. It is the responsibility of the Contractor to dispose of the flushed water from the project area. The Contractor shall take all precautions necessary in providing for adequate drainage from the site. The disposal of water is described later in this Section.

1. Underground fire mains shall be flushed at the flow rates specified below per N.F.P.A. 24 10.10.2.1.3 according to the maximum pipe size in the line. While conducting the flushing operation, the Contractor shall exercise care that the water does not create any damage. The Contractor shall be responsible for any damage caused by this operation.

Flow required to produce a velocity of 10 ft per second in pipes:

4" – 390 GPM	8" – 1560 GPM	12" – 3520 GPM
6" – 880 GPM	10" - 2440 GPM	

3.08 HYDROSTATIC (PRESSURE) TESTING FOR (PRIVATE) FIRE PROTECTION SYSTEM

A. The Contractor shall hire a licensed independent subcontractor to conduct the required hydrostatic testing of newly laid pipelines. Unless specified differently on the plans or as supplemented herein, hydrostatic testing shall comply with NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances," 2016 Edition. After completion of the hydrostatic testing, the sub-contractor shall fill out the certificate shown in Figure 10.10.1, N.F.P.A. 24, 2016 Edition, located at the end of this specification. The General Contractor & Inspector shall be present during the testing.

B. Preparation for the Hydrostatic Test

1. All concrete anchor and thrust blocks associated with sections of the pipelines to be tested, shall have cured for a minimum time of 72 hours prior to any flushing or pressurizing of the pipeline. Restrained joints or other methods of pipe support may be used to reduce this time if approved by the Inspector.

2. The Contractor shall flush the pipeline with potable water to remove dirt and debris. Flushing and disposal of water is discussed elsewhere in this Section.

3. The amount of pipeline footage to be tested at one time shall be determined by the Inspector and shall not exceed 1,000 feet in length. Test plates (bulkheads), corporation stops, and

other temporary facilities required for testing purposes shall be installed at the Contractor's expense. Testing against valves is not permitted unless approved by the Inspector.

4. Each hydrant and control valve shall be fully opened and closed under system water pressure to ensure proper operation.

C. Procedures for Hydrostatic Testing

1. Each section of pipeline and all fire hydrants, services, and appurtenances connected thereto, shall be subjected to the hydrostatic test. The pipeline shall be filled with potable water. Care shall be exercised to see that provisions are made for the escape of air at high points and ends of laterals. Contractor shall see that all combination air release valves are open and operating. After the line has been completely filled, it shall be allowed to stand at 40 psi minimum pressure for a sufficient length of time to permit the escape of any pockets of air and allow the mortar lining to absorb the maximum moisture. During this time, all visible pipe, fittings and joints shall be inspected for leakage.

2. All new private fire service mains shall be tested hydrostatically at not less than 200 psi pressure for two hours or at 50 psi in excess of the maximum static pressure when the maximum static pressure is in excess of 150 psi.

D. Repetition of Hydrostatic Test

1. If the leakage in the section of pipeline being tested exceeds the maximum allowable rate specified herein, such section will be considered defective. The plumbing contractor shall determine the points of leakage and make the necessary repairs at his expense. The subcontractor will then conduct another hydrostatic test. This procedure shall be continued until the leakage falls below the allowed maximum.

2. The amount of leakage in buried piping shall be measured at the specified test pressure by pumping from a calibrated container. For new pipe, the amount of leakage at the joints shall not exceed two quarts per hour (1.89L/h) per 100 gaskets or joints irrespective of pipe diameter.

3. The amount of allowable leakage shall be permitted to be increased by one fluid ounce per inch valve diameter per hour (30 ml / 25 mm/h) for each metal seated valve isolating the test section.

4. Tests shall be made by the contractor in the presence of the authority having jurisdiction or the representative of the owner. Contractor shall fill out the certificate shown in Figure 10.10.1, N.F.P.A. 24, 2016 Edition, located at the end of this specification.

E. After Satisfactory Hydrostatic Test

1. All valves shall be tested for leak proof tightness after the pipeline hydrostatic test with the test pressure on one side of the valve and atmospheric pressure on the other side.

2. Regardless of the hydrostatic test results, the Contractor shall repair all detectable leaks.

3.09 HYDROSTATIC (PRESSURE) TESTING FOR DOMESTIC WATER SYSTEM

A. The Contractor shall conduct the required hydrostatic testing of newly laid pipelines. After completion of the hydrostatic testing, the subcontractor shall provide a signed copy of all test results to the Inspector. The Contractor and Inspector shall be present during the testing.

B. Test PVC plastic water system in accordance with UBPPA UNI-B-3 for pressure and leakage. The amount of leakage from PVC piping shall not exceed the amounts given in UBPPA UNI-B-3, except that no leakage is permitted for joints installed with sleeve type mechanical couplings.

C. Test water service lines in accordance with applicable requirements of AWWA C 600. No leakage is permitted

D. Pressure testing: Before pressure test, fill portion of piping being tested with water for a minimum of 24 hours. Provide hydrostatic pressure of 50 psi greater than the maximum working pressure of tested system. Provide and maintain hydrostatic test pressure for at least 2 hours to ensure no leakage of any portion of piping or appurtenances under pressure test.

E. Repetition of Hydrostatic Test: If the leakage in the section of pipeline being tested exceeds the maximum allowable rate specified above, such section will be considered defective. The Contractor shall determine the points of leakage and make the necessary repairs at his expense. The subcontractor will then conduct another hydrostatic test. This procedure shall be continued until the leakage falls below the allowed maximum.

F. After Satisfactory Hydrostatic Test:

1. All valves shall be tested for leak proof tightness after the pipeline hydrostatic test with the test pressure on one side of the valve and atmospheric pressure on the other side.

2. After test sections have successfully met the hydrostatic test requirements to the satisfaction of the Inspector, the entire pipeline or each test section shall be filled or shall remain filled with potable water until the pipeline is disinfected. Test plates, corporation stops, and other test facilities shall remain in place if needed for disinfecting or removed as directed by Inspector.

3. Regardless of the hydrostatic test results, the Contractor shall repair all detectable leaks.

3.10 DISINFECTION PROCEDURES

A. Fire mains, on private property, do NOT need to be disinfected.

B. All potable water lines MUST be disinfected per the following requirements.

C. The Contractor shall supply all materials, labor, equipment and methods necessary to disinfect the water main. The Contractor shall hire a State certified laboratory to perform the required bacteriological tests for the newly laid pipelines.

D. Preparation for Disinfecting Pipelines: Contractor shall tightly shut off every service connection served by the pipeline being disinfected at the curb stop before water is applied to the pipeline. Care should be taken to expel all air from the main and services during the filling operation.

E. Inject solution of liquid chlorine or sodium hypochlorite and water containing at least 50 PPM of free chlorine into a system in a manner to ensure that entire system is completely filled with solution. During this procedure operate valves and test outlets for residual chlorine. Continue injection until outlets indicate at least 59 PPM of free chlorine.

F. After injection, isolate system and hold solution in retention for a period of at least 8 hours. Perform tests for residual chlorine after retention. If such tests indicate less than 50 PPM of residual chlorine, repeat entire procedure. After satisfactory sterilization has been verified, flush entire system until all traces of chlorine have been removed or until chlorine content is no greater than in existing water supply.

3.11 DISPOSAL OF TEST WATER

A. The disposal of all water used in flushing, hydrostatic testing, and disinfecting the sections of pipeline shall be the sole responsibility of the Contractor. The disposal of water shall, in all cases, be carried out in strict observance of the water pollution control requirements of the California Regional Water Quality Control Board.

B. The Contractor shall obtain an NPDES permit and comply with that permit in his discharge of test water.

C. The Contractor shall apply a reducing agent to the solution to neutralize residual chlorine or chloramines remaining in the water. Additionally, the flow of water from the sections of pipeline shall be controlled to prevent erosion of surrounding soil, damage to vegetation, altering of ecological conditions in the area, and damage to any construction or maintenance activity occurring in any ditch or storm drain downstream of discharge.

3.12 CONNECTING TO EXISTING DISTRIBUTION SYSTEM

A. After all hydrostatic tests and disinfecting has been completed and demonstrated to comply with the Specifications, the Contractor shall connect newly laid pipeline to the existing distribution system.

B. Where connections are to be made to an existing potable water system, swab or spray the interior surfaces of all pipe and fittings used in making the connections with a five (5) percent or greater hypochlorite solution as directed by the Inspector.

C. As soon as the connection is completed, thorough flushing is required until all discolored water is removed.

3.13 REMOVAL OF TEMPORARY PIPING AND APPURTENANCES

A. After the newly laid section of pipeline has been approved by the Inspector for connection to the existing distribution system, the Contractor shall disconnect and remove all temporary piping, fittings, test plates, backflow devices, and other appurtenances used for pressure testing, chlorinating, and flushing.

B. Contractor shall remove and replace all stops used for testing and disinfecting of the pipeline with stainless steel repair clamps.

3.14 CLEANING

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.15 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.16 CONTRACTOR’S MATERIAL & TEST CERTIFICATE FOR PRIVATE FIRE SERVICE MAINS

Contractor's Material and Test Certificate for Underground Piping

PROCEDURE

Upon completion of work, inspection and tests shall be made by the contractor's representative and witnessed by an owner's representative. All defects shall be corrected and system left in service before contractor's personnel finally leave the job.

A certificate shall be filled out and signed by both representatives. Copies shall be prepared for approving authorities, owners, and contractor. It is understood the owner's representative's signature in no way prejudices any claim against contractor for faulty material, poor workmanship, or failure to comply with approving authority's requirements or local ordinances.

Property name		Date	
Property address			
Plans	Accepted by approving authorities (names)		
	Address		
	Installation conforms to accepted plans	❑ Yes	❑ No
	Equipment used is approved	❑ Yes	❑ No
	If no, state deviations		
Instructions	Has person in charge of fire equipment been instructed as to location of control valves and care and maintenance of this new equipment? If no, explain	❑ Yes	❑ No
	Have copies of appropriate instructions and care and maintenance charts been left on premises? If no, explain	❑ Yes	❑ No
Location	Supplies buildings		
Underground pipes and joints	Pipe types and class	Type joint	
	Pipe conforms to _____ standard	❑ Yes	❑ No
	Fittings conform to _____ standard	❑ Yes	❑ No
	If no, explain		
	Joints needing anchorage clamped, strapped, or blocked in accordance with _____ standard If no, explain	❑ Yes	❑ No
Test description	Flushing: Flow the required rate until water is clear as indicated by no collection of foreign material in burlap bags at outlets such as hydrants and blow-offs. Flush at one of the flow rates as specified in 10.10.2.1.3. Hydrostatic: All piping and attached appurtenances subjected to system working pressure shall be hydrostatically tested at 200 psi (13.8 bar) or 50 psi (3.5 bar) in excess of the system working pressure, whichever is greater, and shall maintain that pressure ±5 psi (0.35 bar) for 2 hours. Hydrostatic Testing Allowance: Where additional water is added to the system to maintain the test pressures required by 10.10.2.2.1, the amount of water shall be measured and shall not exceed the limits of the following equation (for metric equation, see 10.10.2.2.6): $L = \frac{SD\sqrt{P}}{148{,}000}$ L = testing allowance (makeup water), in gallons per hour; S = length of pipe tested, in feet; D = nominal diameter of the pipe, in inches; P = average test pressure during the hydrostatic test, in pounds per square inch (gauge)		
Flushing tests	New underground piping flushed according to _____ standard by (company) If no, explain	❑ Yes	❑ No
	How flushing flow was obtained ❑ Public water ❑ Tank or reservoir ❑ Fire pump	Through what type opening ❑ Hydrant butt ❑ Open pipe	
	Lead-ins flushed according to _____ standard by (company) If no, explain	❑ Yes	❑ No
	How flushing flow was obtained ❑ Public water ❑ Tank or reservoir ❑ Fire pump	Through what type opening ❑ Y connection to flange and spigot ❑ Open pipe	

NFPA 24 (p. 1 of 2)

FIGURE 10.10.1 Sample of Contractor's Material and Test Certificate for Underground Piping.

Hydrostatic test	All new underground piping hydrostatically tested at _____ psi for _____ hours	Joints covered ❑ Yes ❑ No
Leakage test	Total amount of leakage measured _____ gallons _____ hours	
	Allowable leakage _____ gallons _____ hours	
Forward flow test of backflow preventer	Foward flow test performed in accordance with 10.10.2.5.2: ❑ Yes ❑ No	
Hydrants	Number installed / Type and make	All operate satisfactorily ❑ Yes ❑ No
Control valves	Water control valves left wide open If no, state reason	❑ Yes ❑ No
	Hose threads of fire department connections and hydrants interchangeable with those of fire department answering alarm	❑ Yes ❑ No
Remarks	Date left in service	
Signatures	Name of installing contractor	
	Tests witnessed by	
	For property owner (signed) / Title / Date	
	For installing contractor (signed) / Title / Date	

Additional explanation and notes

NFPA 24 (p. 2 of 2)

FIGURE 10.10.1 *Continued*

END OF SECTION 331000

This page intentionally left blank.

SECTION 333000 - SANITARY UTILITIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Supply and installation of private sanitary sewer system as shown on Construction Documents.

B. Sewage bypass and pumping plan.

C. Spill prevention & emergency response plan.

D. Closed-circuit television inspection of sewer laterals.

E. Contractor shall furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all piping and including the demolition and removal of certain equipment, piping and appurtenances all as required and as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.2 RELATED SECTIONS

A. Trenching Requirements: Conform to the requirements of Section 31 20 00 – Earthwork.

1.3 SUBMITTALS

A. Product Data:

1. Manufacturer’s Catalog data for materials. Include technical data for pipe, gaskets, joints, couplings, and cleanout valve box with lid.

B. Closeout Submittal: Submit three DVD’s of Closed-circuit television inspections performed. Include the following information:

1. Electronic Media Recordings: Visual and audio record of the entire length of pipe. For existing laterals identify problem areas, such as roots, cracks, fractures, broken pipe, and other unusual conditions found.

2. Digital Photographs of the pipe condition, connections, points of interest and defects found. Indicate distance of defects to a point of reference such as face of building or mainline.

3. Inspection Log: Provide written report including:

a. Date and time of inspection.

b. Name Project, Contractor, and operator name.

c. Location, material and size of pipe.

d. Description of defects found, if any.

C. Certificates:

1. Submit manufacturer's certified statement that the pipe has been manufactured and tested in accordance with the applicable requirements of the California Plumbing Code, ASTM, & The Standard Specifications for Public Works Construction.

1.4 LICENSES, PERMITS & FEES

A. The Contractor shall have a Class “C-34” or Engineering “A” Contractors license valid in the State of California.

B. The Contractor shall obtain all necessary permits, licenses, or agreements required by any legally constituted agency, pay for all fees and give all necessary notices required for the construction of the work.

C. The Owner shall reimburse the contractor for all necessary permits or inspection fees by any legally constituted agency.

1.5 DISPOSAL OF REMOVED MATERIALS INCLUDING ASBESTOS-CEMENT PIPE

A. All removed materials, except those indicated on the plans or described herein to remain the property of the Owner, shall become the property of the Contractor and shall be disposed in accordance with local, state, and federal laws. Should any of those materials be considered as hazardous the Contractor shall provide the Owners Inspector with paper custody trail documentation of the disposal.

B. Asbestos – Cement (A-C) Pipe Removal and Disposal: The plans for the project may indicate that existing asbestos-cement pipe is to be removed from the ground. Where so indicated the Contractor shall excavate with care, expose the pipeline and remove the A-C pipe to the nearest joint. Should the plans not call out the removal of the A-C pipe and A-C pipe is encountered, the Contractor shall obtain approval from the Inspector as to whether or not the A-C pipe is to be removed or can be left in place. Cutting of the pipe shall only be done if absolutely there is no other way to expose the length of pipe to the nearest joint that be separated and the Inspector approves the cutting of the pipe. Cutting of the pipe shall be done with a mechanical saw with a pressure water source to dampen the pipe and the dust from the cutting. To remove a coupling, the coupling may have to be broken in the trench. The pipe once removed from the trench may be broken for handling. The breaking shall be done within a plastic bagging or sheeting material to minimize the release of asbestos fibers into the atmosphere. Once removed and broken, if necessary, the A-C material shall be bagged and disposed of legally with the Inspector to be given a copy of all Contractor paperwork as to the legal disposal of the material. If the A-C pipe section(s) are removed intact the pipe can be removed by the Contractor from the project site and become the property and responsibility of the Contractor.

1.6 DRAWINGS

A. Because of the small scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, traps, and other devices which may be required to complete the installation.

B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his acceptance. Only when Architect's acceptance is given, in writing, shall Contractor proceed with installation of the work.

C. In case of a difference in the specifications or drawings, or between the specifications and the drawings or in the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.7 EXAMINATION OF PREMISES

A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.8 PROTECTION

A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.9 LOCATIONS

A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.

B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid confliction and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.

1.10 SUBSTITUTIONS

A. The Contractor assumes full responsibility that alternate manufacturers, items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures which ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates were selected without proper regard to the requirements of the job, will not be approved. No more than one proposed alternate will be considered for each item.

B. This Contractor is responsible to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.

C. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials and decisions of the Architect or that of his representative shall be final and conclusive.

1.11 RECORD DRAWINGS

A. Contractor shall provide and keep up-to-date a complete "as-built" record set of redline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.12 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement:

1. System Description: Grades and elevations are to be established with reference to the benchmarks referenced on the Plans.

2. The work provided herein shall conform to and be in accordance with the Contract Plans, General Conditions/Specifications and Special Provisions, as well as the Standard Specifications for Public Works Construction (“Green Book”), 2015 Edition, adopted by the Southern California Chapter, American Public Works Association; herein referred to as the “Standard Specifications”.

3. California Plumbing Code, CPC, 2016 Edition, Chapter 7.

4. California Administrative Code, Title 22, Section 64630(e)(2).

5. Underwriters Laboratories.

6. American Society of Testing Materials.

1.13 INSPECTION

A. Notice shall be given to the Owner’s Inspector at least 48 hours before starting construction.

B. Contractor shall not allow or cause any of his work to be covered up before it has been duly inspected, tested and approved by the Owner, Architect or any other authorized inspectors having legal jurisdiction over his work. Should he fail to observe the above, he shall uncover the work and, after it has been inspected, tested and approved, recover it at his own expense.

C. Inspection of the work shall not relieve the contractor of any obligations to complete the work as prescribed by the standard specifications. Any known defective work shall be corrected before testing or final inspection will be permitted. Unsuitable materials may be rejected even if these materials have been previously overlooked by the Inspector.

D. The Owner shall have the authority to suspend the work completely or in part for such time as it may deem necessary if the contractor fails to carry out instructions given by the Owner, or to perform any required provisions of the plans and specifications. The contractor shall immediately comply with a written order of the Owner to suspend the work completely or in part. The work shall be resumed when improper methods or defective work are corrected as ordered and approved in writing by the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pipeline:

1. Project site sanitary sewer.

a. PVC Sewer Pipe, ASTM D-3034, SDR-35. The pipe will have a permanently installed reinforced rubber ring gasket in an integral bell joint. PVC Sewer Fittings SDR-35 shall be manufactured in accordance with ASTM Standards D-3034 and F-1336 or F-679. The PVC material shall have a minimum cell classification of 12454-B, 12454-C or 12364-C as defined in ASTM D-1784. Manufactured by J-M, Certainteed, Vinyl Tech, Diamond Plastics Corp, Pacific Western Plastics or approved equal.

b. Acrylonitrile-Butadiene-Styrene Schedule 40 plastic drainpipe and fittings meeting the requirements of ASTM D 2661 and D 3311. Provide ABS solvent cement for piping and joint connections and install in accordance with IAMPO Standards IS 5, 9, and UPC Section 718.

c. Vitrified Clay Pipe (VCP): VCP and fitting shall conform to ASTM C700, Extra Strength.

B. Cleanout Assemblies: Cleanout plug shall be line size.

1. See Construction Documents for details.

C. Concrete, Mortar and Related Materials: Conform to Section 32 13 13 – Cement Concrete Paving.

D. Manhole Brick Mortar, Grout, and Plaster: Conform to Standard Specifications for Public Works Construction, Section 202 - Masonry Materials.

E. Metal Covers, Frames and Accessories:

1. Conform to Section 206 – Miscellaneous Metal Items of the Standard Specifications for Public Works Construction.
2. Metal Covers and Frames: Vandal-resistant design.
3. Hot-dip galvanize all steel parts after fabrication and prior to assembly in accordance with Section 210 – Paint and Protective Coating of the Standard Specifications for Public Works Construction.

F. Bedding Materials: Conform to the requirements of Section 31 20 00 – Earthwork.

PART 3 - EXECUTION ON PRIVATE PROPERTY

3.1 PIPELINE INSTALLATION

A. Install pipeline in a practical alignment and uniform slope to the point of connection as indicated on the plans. Prior to trench excavation, verify size, material, depth, and location of the point of connection. Notify Civil Engineer if point of connection elevation is different then that shown on construction drawings as it may affect the design of the system.

B. No pipe shall be laid until the Geotechnical Project Manager inspects and approves the conditions of the bottom of the trench.

C. Pipe laying shall proceed “up grade” with the spigot section of the bell-and-spigot pipe pointing in the direction of the flow.

D. Each section of pipe shall be laid true to line and grade and in such a manner as to form an close concentric joint with the adjoining pipe and to prevent sudden offsets in the flow line.

E. Where invert elevations are indicated, run pipe at a uniform slope between inverts shown.

F. Join pipes and fittings as recommended by the manufacturer.

G. All sewer lines & cleanouts shall be staked by a licensed surveyor if slope of grade is less than 2% and a complete set of cut sheets shall be supplied to the Inspector. All construction staking shall be installed and verified for grade and alignment prior to the start of construction.

H. Refer to ASTM D 2321-00 “Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications” or Uni-Bell PVC Pipe Association UNI-PUB-6 “Installation Guide for PVC Solid-Wall Sewer Pipe” for installation information.

I. Pipe shall not be laid when the condition of the trench or the weather is unsuitable.

J. The interior of the sewer pipe shall be kept clean of dirt and debris at all times. When work is not in progress, open ends of pipe and fittings shall be plugged.

K. Where clearing after laying is difficult because of small pipe size, a suitable swab or squeegee shall be kept in the pipe and bulled forward past every joint immediately after joining has been completed.

3.2 CLEARANCES OF SANITARY PIPELINE

A. Buildings or Structures - 2 feet.

B. Parallel to Water Line:

1. Building sanitary drain, (that which starts from the building perimeter to existing site sewer) shall not be laid in a common trench with the water line unless the bottom of the water line shall be at least 12 inch above the top of the sewer pipeline.
2. In addition, the water pipe shall be placed on a solid shelf excavated on one side of the common trench with a minimum clear horizontal distance of 12 inch sewer or drain line.
3. Site sanitary sewer (receiving more than one building sanitary drain or acid pipeline) shall be separated from the water line in accordance with the requirements of the State of California, Human and Welfare Agency, Department of Health Services.

C. Crossing Water Line:

1. Building sanitary drain shall be installed a minimum of 12 inches below the potable water line

2. Site sanitary sewer shall be separated from the water main in accordance with the requirements of the State of California Administrative Code, Title 22, Section 64630(e)(2).

3.3 CLEANOUTS

A. In general, provide cleanouts at the upper terminal for each sanitary pipeline, at intervals not exceeding 100 feet in straight run and any fraction thereof and for each aggregate horizontal change in direction exceeding 135 degrees. See construction drawings for locations.

B. Install required cleanouts before horizontal pipelines are covered.

C. In concrete-paved areas, extend cleanouts flush with finish grade.

D. In unpaved and asphalt-paved areas, install cleanouts in yard boxes 4 inches below the yard box cover.

E. In traffic areas, install countersunk cleanout plugs where raised heads protrude.

3.4 PIPE REMOVAL

A. Contractor shall leave the existing campus sewer lines in place during construction except at service laterals to buildings where they shall be removed and disposed.

B. Sewer lines which are to remain as abandoned, but have had pipe cut and removed, shall be capped.

3.5 SEWAGE BYPASS AND PUMPING PLAN

A. The flow of sewage shall not be interrupted. Should the Contractor disrupt the operation of existing sanitary sewer facilities, or should disruption be necessary for performance of the work, the Contractor shall bypass the sewage flow around the work. Sewage shall be conveyed in closed conduits and disposed of in a sanitary sewer system. Sewage shall not be permitted to flow in trenches nor be covered by backfill.

B. Whenever sewage bypass and pumping is required the Contractor shall submit a working drawing detailing his proposed plan of sewage bypass and pumping to the Owner.

C. The plan shall indicate the locations and capacities of all pumps, sumps, suction and discharge lines. Equipment and piping shall be sized to handle the peak flow of the section of sewer line to be bypassed and pumped. Bypass piping, when crossing areas subject to traffic loads, shall be constructed in trenches with adequate cover and otherwise protected from damage due to traffic. Lay-flat hose or aluminum piping with an adequate casing and/or traffic plates may be allowed if so approved by the Engineer. Bypass pump suction and discharge lines that extend into manholes shall be rigid hose or hard pipe. Lay-flat hose will not be allowed to extend into manholes. The Contractor shall provide a backup bypass pumping system in case of malfunction. The backup bypass system shall provide 100 percent standby capability, and be in place and ready for immediate use. Each standby pump shall be a complete unit with its own suction and discharge piping. In addition to the backup system, the Contractor shall furnish and operate vacuum trucks when required to accomplish the work.

D. Prior to the full operation of the bypass system, the Contractor shall demonstrate, to the satisfaction of the Engineer and Inspector, that both the primary and backup bypass systems are fully functional and adequate, and shall certify the same, in writing, to the Engineer in a manner acceptable to the Engineer.

E. The Contractor shall provide one dedicated fuel tank for every single pump/generator, if fuel/generator driven pumps are used. The Contractor shall provide a fuel level indictor outside each fuel tank. The Contractor shall continuously (while in use) monitor the fuel level in the tanks and ensure that the fuel level does not drop below a level equivalent to two (2) hours of continuous bypass system operation. The Contractor shall take the necessary measures to ensure the fuel supply is protected against contamination. This includes, but is not limited to, fuel line water traps, fuel line filters, and protecting fuel stores from precipitation.

F. The Contractor shall provide an emergency standby power generator, if electric power driven pumps are used.

G. The Contractor shall continuously (while in use) monitor the operation of the bypass system and all impacted facilities. The Contractor shall submit, as part of their bypass plan, their monitoring procedure and frequency and shall maintain a log of the monitoring in a manner acceptable to the Engineer and Inspector.

H. The Contractor shall continuously monitor the flow levels downstream and upstream of the bypass to detect any possible failure that may cause a sewage backup and/or spill, and shall include the means and methods of monitoring the flow in their Spill Response Plan.

I. The Contractor shall routinely inspect and maintain the bypass system, including the backup system. The Contractor shall submit as part of their bypass plans their maintenance procedures and frequency and shall maintain a log of all pertinent inspection, maintenance and repair records in a manner acceptable to the Engineer and Inspector.

J. All costs associated with sewer bypass requirements listed above shall be included in the Bid Item “Sewer Bypass System”. If such Bid Item is not included in the Bid Form, include all costs associated with sewer bypass in the cost of other related bid items of work.

3.6 SPILL PREVENTION & EMERGENCY RESPONSE PLAN

A. The Contractor shall prepare and submit a spill prevention and emergency response plan. The plan shall address implementation of measures to prevent sewage spills, procedures for spill control and containment, notifications, emergency response, cleanup, and spill and damage reporting.

B. The Contractor shall be in full charge and be responsible for the Jobsite, the construction work of this contract, and subject to the directions of the Engineer or the Inspector. The Contractor shall observe and comply with all Federal, State, and local laws, ordinances, codes, orders, and regulations which in any manner affect the conduct of the work, specifically as it relates to sewage spills. The Contractor shall be fully responsible for preventing sewage spillage, containing any sewage spillage, recovery and legal disposal of any spilled sewage, any and all fines, penalties, claims and liability arising from negligently causing a sewage spillage and any violation of any law, ordinance, code, order, or regulation as a result of the spillage.

C. The plan shall account for all storm drain systems and water courses within the vicinity of the work which could be affected by a sewage spill. Catch basins that could receive spilled sewage shall be identified. These catch basins shall be sealed prior to operating the bypass and pumping system. The Contractor shall remove all material used to seal the catch basins when the bypass and pumping system operations are complete.

D. The Contractor shall be fully responsible for containing any sewage spillage, preventing any sewage from reaching a watercourse, recovery and legal disposal of any spilled sewage, any fines or penalties associated with the sewage spill imposed upon by the Agency and/or the Contractor by jurisdictional regulatory agencies, and any other expenses or liabilities related to the sewage spill.

E. The Contractor shall exercise care not to damage existing public and campus improvements, interrupt existing services and/or facility operations that may cause a sewage spill. Any reasonably anticipated utility and/or improvement damaged by the Contractor shall be immediately repaired at the Contractor’s expense. If construction operations damage an existing utility or damage or interrupt an existing service resulting in a sewage spill, the Contractor shall immediately notify the Owner. Before the start of construction, the Contractor shall request and obtain from the Owner an emergency roster of designated Owner representatives with their respective phone numbers, pager numbers, and cellular phone numbers. The Contractor shall take all measures necessary to prevent further damage or service interruption to an impacted utility or service. The Contractor is responsible for any resulting sewage spill(s).

3.7 PROTECTION

A. Where new building sewers are to be connected into a sewer line which is in active use, the CONTRACTOR shall call for such protection as is necessary to prevent construction debris from being washed into the active sewers. Plugged inlets or other suitable protection shall be called for in the active manhole before beginning manhole modifications or tract sewer cleaning.

3.8 CLOSED-CIRCUIT TELEVISION INSPECTION

A. Coordinate with owners inspector time and date of inspection. Project Inspector shall be present during the CCTV inspection.

B. Clean laterals by hydraulic jet.

C. Perform internal closed-circuit television inspection of lateral from the building to the campus mainline. Record sewer in its entirety with no breaks or interruptions. Move camera at a speed no greater than 30 feet per minute, stopping for a minimum of ten seconds to record pipe connections, defects, and points of interest.

D. Maintain technical quality, sharp focus and distortion free picture. Pan, tilt, and rotate as necessary to best view and evaluate connections, defects and points of interest.

E. Closed-circuit Television Equipment: As a minimum equipment shall include:

1. Television camera specially designed for pipe inspections, and operative in 100 percent humidity conditions.

2. Camera and television monitor capable of producing minimum 470H-line resolution color video picture.

3. Camera capable to inspect laterals as small as three inches up to 70 feet from sewer mainline.

4. Camera lighting shall be suitable to allow clear picture of inner wall at least ten feet in front.

F. Defective Work:

1. New Laterals: Defective Work found shall be repaired at Contractor’s expense. Perform a new closed-circuit television inspection at no cost to owner.

2. Existing Laterals:

a. If roots, sludge, or sediment material or other defect not related to the Work of this project impedes inspection, withdraw camera, restart inspection from opposite end and notify Owner of defects found.

3. If obstruction or stoppage was caused by Work related to this project, remove obstruction at no cost to Owner. Perform a new closed-circuit television inspection at Contractor’s expense.

3.9 TESTING OF SEWER PIPE

A. After installation of sewer pipe, testing shall be performed. The piping of the sewer system shall be tested with water or air except that plastic pipe shall not be tested with air. Contractor to follow guidelines set forth by the California Plumbing Code section 712.0 Testing.

3.10 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION 333000

SECTION 334000 - STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Contractor shall furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all piping and including the demolition and removal of certain equipment, piping and appurtenances all as required and as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

B. Supply and installation of private storm drain system from building wall perimeter, unless otherwise noted, to a point within the owner's property as shown on the construction documents.

1.2 SUBMITTALS

A. Product Data: Manufacturer's catalog data for all required materials. Include technical data for pipe, drain inlets, catch basins, grates, catch basin filter inserts, information concerning gaskets, joints and couplings.

B. Contractor is responsible for providing shoring plans to the Inspector for approval prior to construction. Excavation shall have sheeting, shoring and bracing conforming to CAL/OSHA requirements. Lateral pressures for design of sheeting, shoring and bracing shall be based on type of soil exposed, groundwater conditions, surcharge loads adjacent to the excavation and type of shoring that will be used.

1.3 RELATED SECTIONS

A. Trenching Requirements: Conform to the requirements of Section 31 20 00 – Earthwork.

1.4 LICENSES, PERMITS & FEES

A. The Contractor shall have a Class "C-34", "C-36", "C-42" or Engineering "A" Contractors license valid in the State of California.

B. The Contractor shall obtain all necessary permits, licenses, or agreements required by any legally constituted agency, pay for all fees and give all necessary notices required for the construction of the work.

C. The Owner shall reimburse the contractor for all necessary permits or inspection fees by any legally constituted agency.

1.5 QUALITY ASSURANCE

A. The work provided herein shall conform to and be in accordance with the Contract Plans, General Conditions/Specifications and Special Provisions, as well as the Standard Specifications for Public Works Construction ("Green Book"), 2015 Edition, adopted by the Southern California Chapter, American Public Works Association; herein referred to as the "Standard Specifications".

1.6 PROTECTION

A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate with other utility work.

1.8 DISPOSAL OF REMOVED MATERIALS

A. All removed materials, except those indicated on the plans or described herein to remain the property of the Owner, shall become the property of the Contractor and shall be disposed in accordance with local, state, and federal laws. Should any of those materials be considered as hazardous the Contractor shall provide the Owners Inspector with paper custody trail documentation of the disposal.

1.9 SUBSTITUTIONS

A. The Contractor assumes full responsibility that alternate manufacturers, items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures which ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates were selected without proper regard to the requirements of the job, will not be approved. No more than one proposed alternate will be considered for each item.

B. This Contractor is responsible to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.

C. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials and decisions of the Architect or that of his representative shall be final and conclusive.

1.10 RECORD DRAWINGS

A. Contractor shall provide and keep up-to-date a complete "as-built" record set of redline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, pipe invert locations, drain basins, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.11 INSPECTION OF WORK

A. Contractor shall not allow or cause any of his work to be covered up before it has been duly inspected, tested and approved by the Owner or any other authorized inspectors having legal jurisdiction over his work. Should he fail

to observe the above, he shall uncover the work and, after it has been inspected, tested and approved, recover it at his own expense.

B. Inspection of the work shall not relieve the contractor of any obligations to complete the work as prescribed by the standard specifications. Any known defective work shall be corrected before testing or final inspection will be permitted. Unsuitable materials may be rejected even if these materials have been previously overlooked by the Inspector.

C. The Owner shall have the authority to suspend the work completely or in part for such time as it may deem necessary if the contractor fails to carry out instructions given by the Owner, or to perform any required provisions of the plans and specifications. The contractor shall immediately comply with a written order of the Owner to suspend the work completely or in part. The work shall be resumed when improper methods or defective work are corrected as ordered and approved in writing by the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Solid Wall Piping Materials

1. Poly Vinyl Chloride (PVC) Sewer Pipe, ASTM D-3034, SDR-35. The pipe will have a permanently installed reinforced rubber ring gasket in an integral bell joint. PVC Sewer Fittings SDR-35 shall be manufactured in accordance with ASTM Standards D-3034 and F-1336 or F-679. The PVC material shall have a minimum cell classification of 12454-B, 12454-C or 12364-C as defined in ASTM D-1784.

2. Cast iron soil, hubless, with stainless steel-banded hubless couplings. No-hub cast iron soil pipe and fittings shall conform to ASTM A 888 and/or standard specifications 301 of the Cast Iron Soil Pipe Institute. No-hub joints shall conform to specification 310 of the Cast Iron Soil Pipe Institute and/or ASTM C 1277. Joints shall be installed according to manufacturer's recommendations. Manufactured by American Foundry, Tyler, or equal.

3. Poly Vinyl Chloride (PVC) Plastic Pipe, Schedule 40, meeting ASTM D 1785 standards. Fittings shall conform to ASTM D 2467 "Socket-Type PVC Plastic Type Fittings, Schedule 40.

B. Grates & Covers:
1. All grates and covers must be vandal proof / bolt down type.
2. A.D.A. - Where noted on the plans install A.D.A. grates on catch basins. A maximum spacing between grating bars in accessible path of travel is 1/2 inch in the direction of travel, or 1/2 inch in either direction when the path of travel is not limited to one direction.
3. Heel Proof - Where noted on the plans install heel proof grates on catch basins requiring a maximum ¼ inch opening.

C. Steel Reinforcing Bars: ASTM A 615 deformed grade 40 billet steel, plain finish, unless otherwise specified on Construction Document.

D. Concrete, Mortar and Related Materials: Conform to Section 32 13 13: Cement Concrete Pavement.

E. Manhole Brick Mortar, Grout, and Plaster: Conform to Standard Specifications for Public Works Construction, Section 202 - Masonry Materials.

F. Paint and Protective Coatings

1. All storm drain hardware, including frames and covers, grates, protection bars, steps, etc., shall be protected from corrosion. Storm drain hardware made of cast iron shall be protected by painting with, or dipping in, a commercial grade asphalt paint. Storm drain hardware made of steel shall be galvanized.
2. Hot-dip galvanize steel parts after fabrication and before installation, in accordance with Section 210 - Paint and Protective Coating of the Standard Specifications for Public Works Construction.

PART 3 - EXECUTION

3.1 PIPELINE INSTALLATION

A. Existing utilities: Locate existing underground utilities in all areas of work prior to excavation or commencement of work. If utilities are to remain in place provide adequate means of protection during trenching operations.

B. Install pipeline in a practical alignment and uniform slope to the point of connection as indicated on Construction Document. Prior to trench excavation, verify size, material, depth, and location of the point of connection. Notify Civil Engineer if point of connection elevation is different then that shown on construction drawing as it may affect the design of the system.

C. Excavating, trenching, and backfilling are specified in Section 31 20 00 – Earthwork.

D. No pipe shall be laid until the Geotechnical Project Manager inspects and approves the conditions of the bottom of the trench.

E. All storm drain pipelines, trench drains, catch basins and drain inlets shall be staked by a licensed surveyor if slope of grade is less than 2% and a complete set of cut sheets shall be supplied to the Inspector. All construction staking shall be installed and verified for grade and alignment prior to the start of construction.

F. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical.

G. Use proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

H. Make connections to existing piping and underground structures so finished work complies as nearly as practical with requirements specified for new work.

I. The cutting of pipe for inserting tees, fittings or closure pieces shall be done in a neat workmanlike manner without damage to the pipe or cement lining and so as to leave a smooth end at right angles to the axis of the pipe. No pipe shall be laid in water or when, in the option of the Engineer trench conditions are unsuitable.

J. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the trench. If the pipe-laying crew cannot put the pipe into the trench and in place without getting soil into it, the Engineer may require that before lowering the pipe into the trench, a temporary plug be placed over each end and left there until the connection is to be made to the adjacent pipe. During the laying operations, no debris, tools, clothing or other materials shall be left in the pipe.

K. At times when pipe laying is not in progress, the open ends of pipe shall be closed by watertight plug or other means approved by the Engineer. This provision shall apply during the lunch-hour breaks as well as overnight. If water is in the trench, the seal shall remain in place until the trench is pumped completely dry.

L. All grates, frames and covers for drain inlets, catch basins & trench drains shall be locked down to prevent theft after final construction.

3.2 FIELD INSPECTION FOR PIPE & FITTINGS

A. Television Inspection: The entire length of all new storm drain pipe 6" AND GREATER shall be inspected using Closed-Circuit Television (CCTV) equipment. The inspection shall be conducted after the line has been successfully installed, covered with bedding material, and prior to paving. The inspection shall be conducted in the presence of the Inspector. All labor and equipment necessary to conduct the CCTV inspection shall be furnished by the Contractor. CCTV inspection shall be per the following.

1. Record the inspection using a four-head, VHS format, video cassette recorder in standard play mode. Deliver the original videotapes, audio commentary, log sheets, and reports to the I.O.R. at the close of the each working day. As desired, the Contractor may produce duplicates for his own use. At the option of the Contractor, or request of the Owner, the video recordings may be converted to MPEG format and copied unto a DVD compatible with Microsoft software.
2. CCTV Equipment: Camera: Remote-controlled, focus from 6" to infinity. Resolution at 450 lines per inch, minimum. During the reinstatement of laterals, only use "rotating lens" or "pan and tilt" cameras. Footage counter: Accurate within ±1%. Include the real time counter measurement as a caption on the recorded tape. Use maintenance hole stations and maintenance hole numbers as references. Television monitor: Color, minimum 460 lines per inch resolution. Lighting: Adequate to fully illuminate the pipeline and positioned to not produce glare. Mobility: Capable of steadily traveling with or against the flow. The maximum speed while inspecting and recording is 9 m per minute (30 feet per minute).
3. Quality of CCTV Inspection Record: The recorded video image must clearly show the full circumference of the pipeline, in focus, with adequate lighting to see detail, with uniform and steady travel, and depicting the date and time of inspection, footage of travel, street, project title and pipe size. At laterals, service connections and pipe defects, provide a closer, more detailed examination and document the orientation, location and size. The written records must further describe those laterals, service connections and pipe defects and index them to their location on the video record.
4. Introduce water into the upstream end of the pipe for the required length of time such that the water flow leaving the pipe at the downstream end equals the flow entering the upstream end of the pipe. Discontinue water flow and perform the CCTV inspection of the pipe.
5. If debris is encountered, retrieve the CCTV unit, re-clean the pipeline and resume CCTV inspection. Pipe will be considered acceptable when the video camera records no ponding of water (except in joint recesses) within the pipe, no breaks in the pipe and no openings or breaks at the joints, and the pipe is clean and free of dirt and debris. Remove and replace, or readjust to grade, any pipe failing to meet the acceptable video requirements.
6. At the completion of the video inspection, one copy of the tapes shall be turned over to the I.O.R.
7. Defects requiring correction include the following:
    1) Alignment: Less than full diameter of inside of pipe is visible between structures.
    2) Crushed, broken, cracked, or otherwise damaged piping.
    3) Exfiltration: Water leakage from or around piping.
    4) Infiltration: Water leakage into piping.

    b. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.

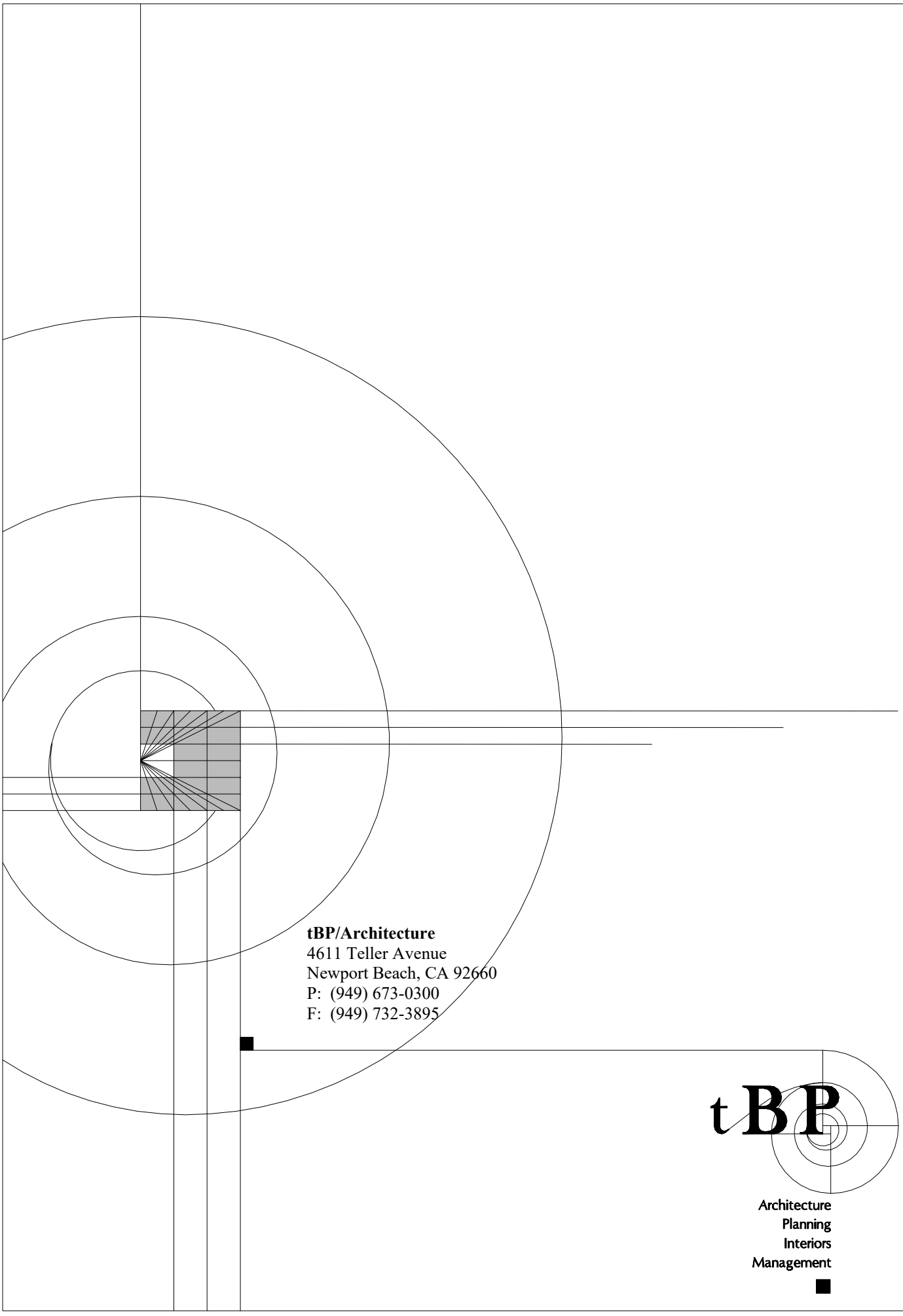
    c. Re-inspect and repeat procedure until results are satisfactory.

B. CLEANUP

3.3 Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION 334000

This page intentionally left blank.



tBP/Architecture
4611 Teller Avenue
Newport Beach, CA 92660
P: (949) 673-0300
F: (949) 732-3895

tBP

Architecture
Planning
Interiors
Management