

Date: September 23, 2019

ADDENDUM NO. 3

To Project Bidding Documents for:

RFQ CCC-055

A#03-119458

Instructional Building #2

Compton Community College District

tBP Project. No. 20998.00

tBP/ARCHITECTURE

4611 Teller Avenue

Newport Beach, CA 92660

949/673-0300

TO: PROSPECTIVE BIDDERS

This Addendum forms a part of the Contract Documents and modifies the original approved Bidding Drawings. Acknowledge receipt of this Addendum in space provided on the Bid Form. Failure to acknowledge may subject Bidder to disqualification.

GENERAL INFORMATION.

1. The contractor shall include in their bid the costs associated with the requirements shown on the supplemental geotechnical report dated September 4, 2019. Attached to this Addendum
2. The contractor will add abatement and hazardous waste disposal of twenty-two (22) fire doors in Building D – West per the attached Abatement addendum from Bainbridge Environmental Consultants. Attached to this Addendum.
3. Responses to Bidding RFCs are attached to this addendum

CHANGES TO THE SPECIFICATIONS.

1. SECTION 000110 - TABLE OF CONTENTS - Replace existing table of Content by new spec section included in this addendum. See attachments
2. SECTION 010100 - SCOPE OF WORK -
 - a. Replace previously issued page 17 of Section 010100 Scope of Work (Contractor Laydown Area and Access plan) with the attached Section 010100 Scope of Work Logistics Plan showing revised laydown area, revised fencing and contractor entrance to the site. See attachments
 - b. Delete 010100.1.2.A.a.A Phase 2 #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".

- c. Add the following sentences to the end of 010100.1.2.A.a.B.2“
Construction fencing shall be configured to provide access for deliveries to both the Cafeteria and Bookstore in Building Q & R. Access to the site will be allowed from the west side of the site in Parking Lot G. Contractor Laydown area has been moved to an area near Parking Lot H and the MLB Ball fields. Access to the ball fields must not be blocked.”
 - d. Add the following sentence to the end of 010100.1.2.A.a.B.6 “ALL deliveries of material and equipment on large/long bed trucks must be done by 7:00AM or on Friday or Saturday”.
3. SECTION 024113 - SELECTIVE SITE DEMOLITION – Add the entire new section to Division 02. Included in this addendum. See attachments.
 4. SECTION 033543 - POLISHED CONCRETE FINISHING. Add the entire new section to division 03. Included in this addendum. See attachments.
 5. SECTION 042100 - CLAY UNIT MASONRY. Add the entire new section to division 04. Included in this addendum. See attachments.
 6. SECTION 042113.13 - BRICK VENEER MASONRY. Replace existing spec, in division 04, by new spec included in this addendum. See attachments.
 7. SECTION 072100 - THERMAL INSULATION. Replace existing spec, in division 07, by new spec included in this addendum. See attachments.
 8. SECTION 075419 - POLYVINYL CHLORIDE PVC ROOFING Replace existing spec, in division 07, by new spec included in this addendum. See attachments.
 9. SECTION 083473.13 - METAL SOUND CONTROL DOOR ASSEMBLIES. Replace existing spec, in division 08 by the new spec included in this addendum. See attachments.
 10. SECTION 083473.16 - WOOD SOUND CONTROL DOOR ASSEMBLIES. Replace existing spec, in division 08, by the new spec included in this addendum. See attachments.
 11. SECTION 084113 - ALUMINUM FRAMED ENTRANCES AND STOREFRONTS. Replace existing spec, in division 08. by the new spec included in this addendum. See attachments.
 12. SECTION 084413 - GLAZED ALUMINUM CURTAIN WALLS. Add the new entire section to division 08. Included in this addendum. See attachments.
 13. SECTION 092400 - CEMENT PLASTERING. Replace existing section, in division 09, by the new spec included in this addendum. See attachments.
 14. SECTION 097200 - WALL COVERING. Remove this section from Contract Documents.

15. SECTION 101100 VISUAL DISPLAY UNITS. Remove this section from Contract Documents.
16. SECTION 102219 - DEMOUNTABLE PARTITIONS. Add the entire new section to division 10. Included in this addendum. See attachments.
17. SECTION 105113.20 - METAL CELL PHONE CHARGING LOCKERS. Add the new entire section to division 10. Included in this addendum. See attachments.
18. SECTION 1107113.43 FIXED SUNSCREENS. Replace existing section, in division 11, by the new spec included in this addendum. See attachments.
19. SECTION 230923 DIRECT DIGITAL CONTROL SYSTEM FOR HVAC. Included in this addendum. See attachments.

Article 1.1, Work Included:

Delete Paragraph 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."

Delete Paragraph N: "Include as an added bid item the cost of the scheduling modifications and refinement with the tenant."

Note: Corrected even page header. Added footers.

20. SECTION 231123 FACILITIES NATURAL GAS PIPING. Included in this addendum See attachments.

Article 3.6 Piping Joint Construction

Added Paragraph G, Hanger and Support Installation:

G. HANGER AND SUPPORT INSTALLATION

1. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
2. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
3. Install hangers for steel piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
4. Support horizontal piping within 12 inches of each fitting.
5. Support vertical runs of steel piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

21. SECTION 232113 HYDRONIC PIPING. Included in this addendum See attachments.

Article 2.2 Copper Tube and Fittings

Delete 2.2.B, 2 & 3

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.

Article 3.2 Piping Installations

Delete paragraphs F and M

22. SECTION 265561 – THEATRICAL LIGHTING. Add the new entire section to division 26. Included in this addendum. See attachments.
23. SECTION 272000 –ELECTRONIC NETWORK SYSTEMS INFRASTRUCTURE. Add the new entire section to division 27. Included in this addendum. See attachments.

CHANGES TO DRAWINGS

1. SHEET T-2 SHEET INDEX AND GENERAL INFORMAITON -
 - a. Add to Architectural Drawings Index sheet: A9-3 INTERIOR ELEVATIONS.
2. SHEET C1.2– GRADING PLAN - Added drywell west of Building R and removed storm drain-pipe connection into existing storm drain manhole. See attached new sheet.
3. SHEET C1.7 UTILITY DETAILS Added drywell and catch basin detail. See attached new sheet.
4. SHEET A1-2 FLOOR PLAN SECOND FLOOR - Revisions: See attached new sheet.
 - a. Remove note referring to (4) 8' marker boards at each side typ.in Rooms 225 and 226.
 - b. Add Storm Drains at stairs landings
 - c. Provide alum pan under roof drain at Rm 208 for equipment protection.
 - d. Solar tube shaft through 2nd Flr Typ. Contractor must coordinate trades for clear straight path
 - e. Add square aluminum downspout to match window system east of Rm 203
5. SHEET A2-2 REFLECTED CEILING PLAN SECOND FLOOR. Add missing projector in Room #222 C.R.4

6. SHEET A3-1 ROOF PLAN- Revisions: See attached new sheet.
 - a. Corrected notes referred to type of roof
 - b. Added additional storm Drains and revised Slopes

7. SHEETS A4-1 AND A4-2 EXTERIOR ELEVATIONS, A5-1 AND A5-2 BUILDING SECTIONS and A6-1 WALL SECTIONS
Reference to Roof Elevation 30'-0" shall say "+/- 30'-0".

8. SHEET A7-1 ENLARGED PLANS TOILET ROOMS DETAIL 6 - ROOMS 201,203 THRU 205 SECOND FLOOR. Floor drains and slopes shall match the floor drains and slopes (2% max) shown in DETAIL 2 - ENLARGED PLAN ROOMS 101 thru 104 TOILET ROOMS FIRST FLOOR.

9. SHEET A9-3 INTERIOR ELEVATIONS. Add new sheet to Contract Documents see attached new sheet included in this addendum.

10. SHEET 8.01 DOOR SCHEDULE - Revisions:
Revise the following for Doors 121 and 122: frame material to be grouted HM. In the remarks section change 65 STC to 55 STC.

11. SHEET 9.02 COLOR SCHEDULE - Revisions:
 - a. Revise references to Spec Section, remove 074213 and refer to spec number 074213.23 Composite Metal Panel.
 - b. Replace referenced spec numbers to match specifications numbering system: Spec 099000 by 099123
 - c. Remove Spec reference 101400 and refer to spec 101419
 - d. Remove Spec reference 107110 and refer to aluminum window system spec. for exterior windows sun control devices 084113 & 084413.
 - e. Replace Spec 122400 by 122413 for Roller Shades
 - f. Delete Spec 124813 row add SSS-1 nomination to spec section 124816 Entrance floor grills
 - g. Replace Display Cases manufacturer and color name. See Specs. for information.
 - h. Revise Exterior sign material/color name from Brushed Aluminum to Stainless Steel.
 - i. Add spec Section reference to 088000 GLAZING at reference designation "GL-#".

12. SHEET S3-2 - ROOF FRAMING PLAN.: Roof drains have been relocated; structural framing has been relocated to the updated roof drain locations. See new sheet Included in this addendum

13. SHEET M0-6 - MECHANICAL SITE PLAN- Revised site plan to show demo work and new POC information. See new sheet Included in this addendum t

14. SHEET P0-3 - PLUMBING SITE PLAN, See new sheet Included in this addendum
 - a. Deleted storm drain at Column A & 9 at east.
 - b. Revised storm drain square footage.

15. SHEET P1-1 - PLUMBING FIRST FLOOR PLAN- GRAVITY See new sheet
Included in this addendum
 - c. Revised storm and overflow drain routing.
 - d. Revised storm drain square footage.

16. SHEET P2-1 - PLUMBING SECOND FLOOR PLAN- GRAVITY See new sheet
Included in this addendum
 - e. Revised storm and overflow drain routing.
 - f. Revised storm drain square footage.

17. SHEET P3-1 - PLUMBING ROOF PLAN. See new sheet Included in this
addendum.
 - g. Revised storm and overflow drain locations to match
Architectural.
 - h. Revised storm drain square footage.

18. SHEET P4-2 - PLUMBING ENLARGED PLANS. See new sheet Included in this
addendum.

19. SHEET E0-0.1 SYMBOL LIST, NOTES AND DETAILS
 - a. Revise Electrical Drawing Index per Drawing E0-0.1 attached to
this Addendum.

20. SHEET E0-0.2 SINGLE LINE DIAGRAM
 - a. Revise Single Line Diagram per Drawing E0-0.2 attached to this
Addendum.

21. SHEET E0-0.3 LIGHTING FIXTURE SCHEDULE AND NOTES
 - a. Revise Inverter Panel Schedule EMH for Drawing E0-0.3.
attached to this Addendum.

22. SHEET_E0-0.3A LIGHTING CONTROL RISER DIAGRAM
 - a. Add Drawing E0-0.3A Lighting Control Riser Diagram in its
entirety.

23. SHEET_E1-1.1 FIRST FLOOR LIGHTING PLAN
 - a. Revise First Floor Lighting Plan and Key Notes per Drawing E1-
1.1 attached to this Addendum.

24. SHEET_E2-1.1 FIRST FLOOR POWER PLAN
Revise First Floor Power Plan and Key Notes per Drawing E2-1.1 attached to
this Addendum.

25. SHEET_E2-2.1 SECOND FLOOR POWER PLAN
 - a. Revise Second Floor Power Plan and Key Notes per Drawing E2-2.1
attached to this Addendum.

26. SHEET E2-2.2 ELECTRICAL ROOF PLAN

- a. Revise Electrical Roof Plan and Key Notes per Drawing E2-2.2 attached to this Addendum.
- 27. SHEET E3-1.1 PANEL SCHEDULES
 - a. Revise Panel Schedules per Drawing E3-1.1 attached to this Addendum.
- 28. SHEET E3-1.2 PANEL SCHEDULES
 - a. Revise Panel Schedules per Drawing E3-1.2 attached to this Addendum.
- 29. SHEET EF-1.0 ENLARGED SITE FIRE ALARM PLAN
 - a. Add Fire Alarm / Fire Department connection per Drawing EF-1.0 attached to this Addendum.
- 30. SHEET ET-0.1 TELECOM SYMBOL LIST
 - a. Revise Details and add Notes per Drawing ET-0.1 attached to this Addendum.
- 31. SHEET ET-0.2 ENLARGED TELECOM ROOMS
 - a. Revise Details and add Notes per Drawing ET-0.2 attached to this Addendum.
- 32. SHEET ET-0.3 TELECOM RISER DIAGRAMS
 - a. Add/revise Telecom Risers per Drawing ET-0.3 attached to this Addendum.
- 33. SHEET ET-0.4 TELECOM DETAILS
 - a. Add/revise Telecom Details per Drawing ET-0.4 attached to this Addendum.
- 34. SHEET ET-0.5 TELECOM DETAILS
 - a. Add/revise Telecom Performance Notes per Drawing ET-0.5 attached to this Addendum.
- 35. SHEET ET-0.6 AV WIRING DIAGRAMS
 - a. Revise AV Wiring Diagrams and add Notes per Drawing ET-0.6 attached to this Addendum.
- 36. SHEET ET-1.1 FIRST FLOOR TELECOM PLAN
 - a. Revise First Floor Telecom Plan per Drawing ET-1.1 attached to this Addendum.
- 37. SHEET ET-2.1 SECOND FLOOR TELECOM PLAN
 - a. Revise Second Floor Telecom Plan per Drawing ET-2.1 attached to this Addendum.

---End of Addendum---

ATTACHMENTS

1. General Information: (Total 3)

SUPPLEMENTAL GEOTECHNICAL REPORT
ABATEMENT ADDENDUM FOR BUILDING D
BIDDING RFCs RESPONSES

2. Full Size Documents 30" x 42" Drawings: (Total 31)

C1.2	GRADING PLAN
C1.7	UTILITY DETAILS
A1-2	FLOOR PLAN SECOND FLOOR
A3-1	ROOF PLAN
A9-3	INTERIOR ELEVATIONS
S3-2	ROOF FRAMING
M0-6	MECHANICAL SITE PLAN
P0-3	PLUMBING SITE PLAN
P1-1	PLUMBING FIRST FLOOR PLAN -GRAVITY
P2-1	PLUMBING SECOND FLOOR- GRAVITY
P3-1	PLUMBING ROOF PLAN
P4-2	PLUMBING ENLARGED PLANS
E0-0.1	SYMBOL LIST, NOTES AND DETAILS
E0-0.2	SINGLE LINE DIAGRAM
E0-0.3	LIGHTING FIXTURE SCHEDULE AND NOTES
E0-0.3A	LIGHTING CONTROL RISER DIAGRAM
E1-1.1	FIRST FLOOR LIGHTING PLAN
E2-1.1	FIRST FLOOR POWER PLAN
E2-2.1	SECOND FLOOR POWER PLAN
E2-2.2	ELECTRICAL ROOF PLAN
E3-1.1	PANEL SCHEDULES
E3-1.2	PANEL SCHEDULES
EF-1.0	ENLARGED SITE FIRE ALARM PLAN
ET-0.1	TELECOM SYMBOL LIST
ET-0.2	ENLARGED TELECOM ROOMS
ET-0.3	TELECOM RISER DIAGRAMS
ET-0.4	TELECOM DETAILS
ET-0.5	TELECOM DETAILS
ET-0.6	AV WIRING DIAGRAMS
ET-1.1	FIRST FLOOR TELECOM PLAN
ET-2.1	SECOND FLOOR TELECOM PLAN

3. Specifications (Total 21)

000110 - TABLE OF CONTENTS -
010100 - SCOPE OF WORK -
024113 - SELECTIVE SITE DEMOLITION –
033543 - POLISHED CONCRETE FINISHING.

- 042100 - CLAY UNIT MASONRY.
- 042113.13 - BRICK VENEER MASONRY.
- 072100 - THERMAL INSULATION.
- 075419 - POLYVINYL CHLORIDE PVC ROOFING
- 083473.13 - METAL SOUND CONTROL DOOR ASSEMBLIES.
- 083473.16 - WOOD SOUND CONTROL DOOR ASSEMBLIES.
- 084113 - ALUMINUM FRAMED ENTRANCES AND STOREFRONTS.
- 084413 - GLAZED ALUMINUM CURTAIN WALLS.
- 092400 - CEMENT PLASTERING.
- 102219 - DEMOUNTABLE PARTITION
- 105113.20 - METAL CELL PHONE CHARGING LOCKERS.
- 1107113.43 - FIXED SUNSCREENS
- 230923 - DIRECT DIGITAL CONTROL SYSTEM FOR HVAC
- 231123 - FACILITIES NATURAL GAS PIPING
- 232113 - HYDRONIC PIPING
- 265561 - THEATRICAL LIGHTING
- 272000 - ELECTRONIC NETWORK SYSTEMS INFRASTRUCTURE

Gary Moon
tBP/Architecture



CIVIL ENGINEER
FPL and Associates, Inc.
30 Corporate Park, Suite 401
Irvine, CA 92606
T (949) 252-1688



Alan Wing-Chi Lee
ALAN WING-CHI LEE R.C.E. 34971
EXP. 09-30-19

ELECTRICAL ENGINEER
FBA Engineering
150 Paularino Avenue, Suite A120
Costa Mesa, CA 92626
T (949) 852-9992



PLUMBING AND MECHANICAL ENGINEER

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

STRUCTURAL ENGINEER

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



September 4, 2019

To: Ms. Linda Owens
Director of Facilities
Compton Community College District
1111 East Artesia Blvd.
Compton, CA 90221

Subject: Supplemental Recommendations
Preparing Non-yielding/firm Excavation Bottom
Proposed New Instructional Building #2
Compton College Campus
1111 E. Artesia Boulevard
Compton, CA 90221

United - Heider Inspection Group Project No. 10-18020PW

Reference: United-Heider Inspection Group (February 2018), Preliminary Geotechnical Investigation Report, Proposed New Instructional Building #2, El Camino College Compton Center Campus, 1111 E. Artesia Boulevard, Compton, CA 90221, dated February 21, 2018.

Dear Ms. Owens,

Pursuant to the email request from Sherri Philips of PCM3, Inc., United-Heider Inspection Group is pleased to submit the following supplemental earthwork recommendations for preparing a non-yielding/firm overexcavation bottom for the Proposed New Instructional Building #2. We understand that PCM3 want to use a cheaper alternative instead of using oversize rock blanket that was used during Instructional Building #1 Site grading.

The other conclusions and recommendations presented in United-Heider Inspection Group's Preliminary Geotechnical Investigation Report (February 2018) remain applicable unless modified herein.

Non-yielding/firm Excavation Bottom

Upon excavation/overexcavation to the recommended depths, subgrade soils at the removal bottoms should be moisture-conditioned as needed and recompacted to a minimum of 90 percent relative compaction (per ASTM D1557).

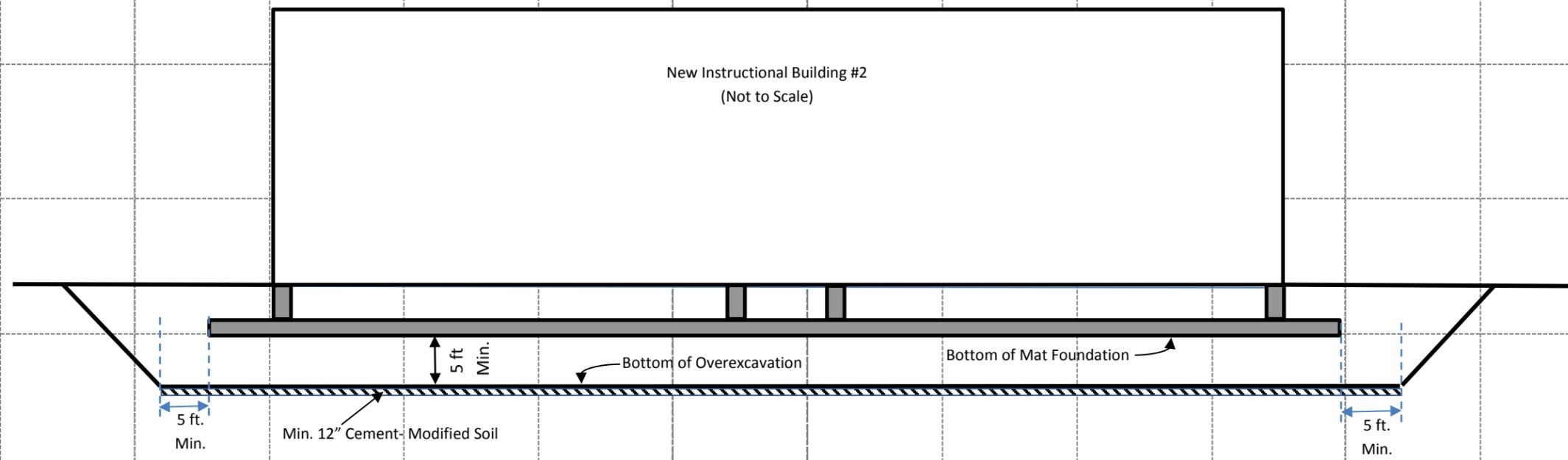
If 90 percent relative compaction cannot be achieved at the excavation bottom due to the anticipated very moist, plastic, and difficult to compact soil conditions, it may be necessary to utilize a cement-modified soil (CMS), a subbase solution that blends cement and water with native (insitu) soils to improve undesirable soil properties. It may be desirable to use 5 percent cement blended into the soil to a minimum depth of 12 inches as shown in the attached cross-section. Specialty contractor should review the field conditions on-site to determine the appropriate cement content and depth of the cement modified soil.

We appreciate the opportunity to be of service to the Compton Community College District. If there is any further question regarding this project, please do not hesitate to contact this office.

Respectfully submitted,
United-Heider Inspection Group

A circular blue seal for a Registered Professional Engineer in the State of California. The seal contains the text: "REGISTERED PROFESSIONAL ENGINEER", "PARAM PIRATHEEPAN", "GE 2826", "Exp 09/30/20", and "STATE OF CALIFORNIA". A handwritten signature in blue ink is written over the seal.

Param Piratheepan, GE
Principal Geotechnical Engineer



Non-yielding/firm Excavation Bottom

Proposed New Instructional Building #2

Compton College Center Campus, 1111 East Artesia Blvd., Compton, CA 90221



Project No: 10-18020PW
Date: September 4, 2019

Scale: Not to Scale

Date: August 30, 2019

To: Compton Community College District
Facilities, Planning & Operations
1111 East Artesia Boulevard
Compton, California 90221



HazMat Abatement Addendum #1 for IB#2 Buildings:

Based on the available information gathered and in addition to the previous sampling data collected, include abatement and hazardous waste disposal of all of the fire doors in Building D - West at the below quoted quantities:

Material Location	Material Description	Approximate Quantity
Building D - West	Fireproofing – Wood Doors (Fire Doors)	22 Doors

If you have any questions regarding this addendum report or require additional information, please do not hesitate to contact our office. We thank you for the opportunity to be of service.

A handwritten signature in blue ink, appearing to read "MR. K. Cisco", is written over a horizontal line.

Karlin Cisco
Project Manager
CAC # 16-5626/CDPH I/A #18300

Bainbridge Project #: 18016299.10
KC/bb

COMPTON COMMUNITY COLLEGE DISTRICT
 RFQ CCC-055 Instructional Building #2
 RFC Questions Answers
 Addendum #3

RFC	Question	Reference Document	Answer
1	<p>Section 27 11 00 Communications Equipment Rooms and section 27 20 00 Electronic Network Systems Infrastructure have a conflict between them. 27 11 00 lists out individual network equipment components and acceptable manufacturers that vary by item. Section 27 20 00 part 1.4,A,2 states " 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: NetClear series; or Siemon - ConvergeIT Series." Neither Belden, CommScope, nor Siemon are listed for the components listed in section 27 11 00 though. Please clarify if Belden, CommScope, and Siemon are acceptable manufacturers for the 110 wiring blocks, category 6 patch panels, patch cables, fiber patch panels, and fiber patch cables listed in section 27 11 00 since they are infrastructure equipment and materials that are supposed to be of the same manufacturer as listed in section 27 20 00, part 1.4,A,2.</p>	271100, 272000, part 1.4,A,2	Campus Standard is "Panduit". See forthcoming addenda with revised specification 27 2000
2	<p>Reference section 04 40 00 Cold-Formed Framing:1) Please see attached RFI #1 from Sierra lathing: The 054000 Cold-Formed Metal Framing section 1.3 Submittals, item B call for shop drawings to "Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation." Please clarify; since this project has DSA Approval and the metal framing is not design deferred, then how would there be any requirement for engineered drawings by the contractor? Please also note this project is not advertised as Design Build and would be in breach of California Public Contract Code Section 1104 for the public entity to require a bidder to assume responsibility for the completeness and accuracy of architectural or engineering plans and specifications on public works projects. 2) Topic also addressed by Vejar, Inc., please see attached: Section 05400 - Cold Formed Metal Framing is asking for shop drawings that are stamped, however, the structural plans already have a stamp for the structural engineer of record. Do we still need to plug in a number for this?</p>	04 4000	Structural calculations/analysis are not required.
3	<p>Plans sheet ES-1.0 depicts M.V. conduits and wire to be removed / per note #3, and rerouted per note #5. Please advise what are the sizes and quantities of these conduits and wires.</p>	Plan sheet ES-1.0	See revised Drawing ES-1.0 issued in Addendum 2.
4	<p>a) Per spec section 08 71 00, hardware sets 1 and 1.1 both show being assigned to doors 001 and 009. Please advise which is the correct hardware set. b) What spec section is responsible for the sliding wood doors at the demountable partitions? c) What are the cylinders that are used on the campus that we are to match? (spec 08 71 00 states "cylinders to match campus standard")</p>	08 7100	<p>a) Doors 001, 009 are scheduled for hdw set 1.1 b) see added spec section 102219 Demountable Partitions as part of addendum #3 c) The campus standard for key/cylinders is ASSA Abloy Assa System Max Plus IC system keying information to come from campus, keying meeting required.</p>

COMPTON COMMUNITY COLLEGE DISTRICT
RFQ CCC-055 Instructional Building #2
RFC Questions Answers
Addendum #3

5	a) Per the manufacturer's listed in spec sections 08 3473.13 (Metal Sound Control Assemblies) and Spec Section 183473.16 (Wood Sound Control Door Assemblies), they are not capable of manufacturing an STC 65 rated door. They are currently only available to provide to and STC 55. b) The wood door manufacturers have only tested their sound control doors with a HM frame. Doors 121 and 122 are shown to be STC rated with a wood door frame. Please change to a HM frame.	183473.16	a)Specs will be revised to reflect 55 STC See Addendum #3 Specs revisions b) There are no wood door frames in this project. Door frames are either aluminum or HM frames. Door frame material will be corrected in Addendum #3 Description of changes to drawings. Sheet 8.01
6	Upon transferring (copy pasting) the text from the Table of Contents: Division 04 - Masonry to a text document, the contents of the text shows a discrepancy: 04 21 00 Clay Unit Masonry is replaced with 04 22 00 Concrete Masonry Unit. The bookmark for Division 04 shows this discrepancy. Please clarify whether the Table of Contents of the Specification is correct for Division 04.	04 2100	Table of Content is correct, the Specifications are being updated in Addendum #3 but we believe the bookmark is incorrect. We do not have Concrete Masonry Units as part of this project.
7	The elevator is noted to have separate fixtures for the Hall Lantern and Position indicators as specified in section 14 24 00 - 24 (2.15 D & E). Please advise if it is feasible to combine the lantern and position indicators to save on costs. The car position indicator and lantern will remain separate as specified in section 14 24 00 - 22 (2.13 G & H).	142400 - 24 (2.15 D & E); 142400 - 22 (2.13 G & H)	Yes, combine per specifications section 2.15 D
8	Section 07 54 19 Polyvinyl-Chloride (PVC) Roofing states the basis of design to be Sika Samafil, but the roof plans A3-1 states the basis of design to be Tremco BURMastic 200 Cold Process Built-Up Roofing System o/ R-30 Rigid Insulation o/ MTL Deck. Please advise how to bid this project with either Sarnafil or Tremco.	07 5419	Section and drawings call out will be revised See new spec in Addendum #3
9	The Owner Controlled Insurance Program (OCIP) will provide Workers' Compensation, Employer's Liability, Contractors' Pollution Liability, and Builders Risk insurance for the Contractor. The Contractor pays for its own Workers' Compensation. Please clarify if the Contractor's Workers' Compensation will be reimbursed by the OCIP.		The Owner, Compton Community College District, will provide the premium for the insurance provided under the OCIP. The OCIP will not reimburse the contractor as there is no premium due by the contractor to participate in the OCIP. Upon enrollment in the OCIP, the contractor may receive a credit from their primary workers' compensation carrier.
10	On sheet ES - 1.0, there are M.V. conduits and wire that shows to be removed per note #3 and re-routed in note #5. What are the sizes and quantities of conduit and wires that need to be removed and re-routed?	ES - 1.0	See revised Drawing ES-1.0 issued in Addendum 2
11	The spec book contains spec 010100 - Scope of Work but the table of contents lists 011000 - Summary. Please clarify if the "Scope of Work" spec provided in the spec book is the correct document for this project.	01 0100	Yes - 010100 Scope of Work is the correct document for this project
12	Specification 033543 Polished Concrete Finishing is specified in the TOC provided in Addendum 1 but no specification is in the specs.	03 3543	Spec is included as part of Addendum #3
13	Please provide an interior elevation detail for the second floor corridor.		See new added sheet A9-3 as part of this addendum
14	Are they going to be any display cases at the second floor corridor?		See new added sheet A9-3 as part of this addendum
15	Addendum 1 added spec sections 097250 - Dry Erase Wall Covering and 097260 - Tackable Wall Covering. These two spec sections cover WC -1 and WC - 2 on the color schedule on A9.02. Please clarify where spec section 097200 - Wall Coverings applies for this project.	097250, 097260, 097200	Spec 097200 is deleted as part of Addendum #3

COMPTON COMMUNITY COLLEGE DISTRICT
 RFQ CCC-055 Instructional Building #2
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16	Please clarify where spec section 087113 - Automatic Door Operators applies to the project. The door schedule does not provide any information on this.	08 7113	Automatic Operators are located at door 001, 003 and 0009. Identified them in Specs, In Electrical Drawings and Hardware specs.
17	Drawing A9-1 shows single leaf doors at the classrooms with a transom above. The door schedule does not show this frame type. Please provide a list of doors that are to have a transom above.	drawing A9-1	Door schedule identifies a transom column and each door with transom is identified and referred to detail 2/8.11
18	Please provide a spec section for the fiber cement panel shown at the mechanical screen wall on drawing 7.02 in detail 8	drawing 7.02 detail 8	Product is described in Detail 8. Only use at mechanical screen.
19	The color schedule on drawing 9.02 lists spec 074313 - Metal Wall Panel. This spec was not found in the spec book. Please provide it.	drawing 9.02, 07 4313	Drawing 9.02 showed Spec section incorrectly Revised to 074213.23 Composite Metal Panel in Addendum #1
20	Drawing A1-1, room 143 and 142 have a callout to provide backing for wall hung shelving per detail 1/6.01. No shelving is shown at these details. Is the GC responsible for this shelving or only the backing?	drawing A1-1, room 143 and 142	These are called out in rooms 143 and 142 as "typical " meaning at every wall that shows dashed lines backing is required. Shelvings are part of a furniture contract. Contractor must install backing per these drawings.
21	Please provide a SWPPPP drawing.		Per the Storm Water Pollution Prevention specification 017416 the Contractors QSD shall prepare the SWPPP drawing. This is also noted on sheet C1.0.
22	Drawing A3-1 indicates the roofing membrane BOD is Tremco BURmastic 200. Spec section 075419 - Polyvinyl Chloride Roofing indicates the roofing membrane BOD is Sika Sarnafil G410. Please specify which roofing membrane manufacturer we are to use.	drawing A3-1, 07 5419	Tremco single ply is bases of design and campus standard. Spec and drawing will be revised as part of addendum #3
23	We request an extension be made to the bid date and RFI deadline.		There will not be an extension to the bid date or the RFC deadline
24	Drawing A1-2 from Addendum 1 is calling for markerboards in rooms 225 and 226 but the interior elevations on A9-1 and A9-2 of Addendum 1 are calling for writable dry erase wall covering. Please confirm that the only marker boards required for the project are the ones at the operable partition in room 126	drawing A1-2, addendum 1; A9-1 and A9-2, addendum 1	There are not marker boards in the classrooms. These are writable dry erase wall coverings. Note at Rooms 225 and 226 will be removed in Addendum#3
25	Drawing 9.02, designation BS-1 is brushed aluminum dimensional letters. Spec section 101419 - Dimensional Letter Signage is calling for stainless steel dimensional letters. Please clarify what material is required.	drawing 9.02, desig. BS-1; 10 1419	Stainless Steel is correct- See addendum #3 Clarification in changes to the drawings, sheet 9.02
26	Drawing 9.02, the following spec sections are listed but are not found in the spec book: 074213 - Metal Wall Panel, 099000 - Paint, 101400 - Sign, 107110 - Exterior Sun Control Devices, 122400 - Window Shades, 124813 - Entrance Floor Mats & Frames. Please clarify.	drawing 9.02, 07 4213, 10 1400, 10 7110, 12 2400, 12 4813	See addendum #3 Clarification in changes to the drawings, sheet 9.02 . We revise these numbers to match specs.074213 by 074213.23 Spec 099000 by 099123 Spec 101400 by 101419 Spec 107110 by 107113.43 Spec 122400 by 122413 Spec 124813 by 124816
27	Spec section 124816 - Entrance Floor Grilles indicates the Basis of Design is C/S Group. Drawing 9.03 calls out floor grilles at keynote EFM-1. Per the color schedule on 9.02 this keynote indicates floor grilles by Mats Inc. Please clarify.	12 4816	Spec Section 124816 is correct. See revisions to sheet 9.03 as part of addendum #3

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28	Spec section 107113.43 - Fixed Sun Screens indicates the Basis of Design is C/S Group. Per the color schedule on 9/02 suncontrol devices SL-1 and SL-2 are Arcadia and LV-1 is C/S Group. Please clarify.	10 7113.43	Windows sun screens are part of the window system and division 08. Trellis sun screens are per division 10. see sheet 7.03 for design and see spec 107113.43 revised in addendum #3.
29	Spec section 101100 - Visual Display Boards indicates the Basis of Design is Epsom. Per the color schedule on 9.02 the markerboard manufacturer is Claridge Concept. Please clarify.	10 1100	Delete spec section 101100 not applicable. See revised 9.02 sheet as part of addendum #3
30	Per the color schedule on 9.02 the wall coverings (WC-1 and WC-2) manufacturer is Koroseal. Spec section 097200 - Wall Coverings does not list this manufacturer. Please clarify.	09 7200	Sheet 9.02 is correct. Spec section 097200 is not applicable remove from Contract documents. See revision in addendum #3
31	Per the color schedule on 9.02 the Linoleum Flooring manufacturer is Johnsonite and Armstrong. Spec section 096543 - Linoleum Flooring lists Armstrong as the Basis of Design. Please clarify.	09 6543	Armstrong or equal
32	Per the color schedule on 9.02 the Alum Framed Entrance manufacturer is Solarban 70XL and Armstrong. Spec section 084113 - Aluminum Framed Entrances & Storefronts lists Arcadia as the Basis of Design. Please clarify.	08 4113	Spec Section 084113 is correct. Spec Section 08800 for glass shall be referenced to all GL- designations.

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NOT USED

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NOT USED

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NOT USED

tBP PROJECT NO: 20998.00
ADDENDUM 03
SEPTEMBER 24, 2019

COMPTON COLLEGE
INSTRUCTIONAL BUILDING #2
COMPTON COMMUNITY COLLEGE DISTRICT

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NOT USED

DIVISION 47 - RESERVED

NOT USED

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NOT USED

DIVISION 49 - RESERVED

NOT USED

END OF DOCUMENT 000110

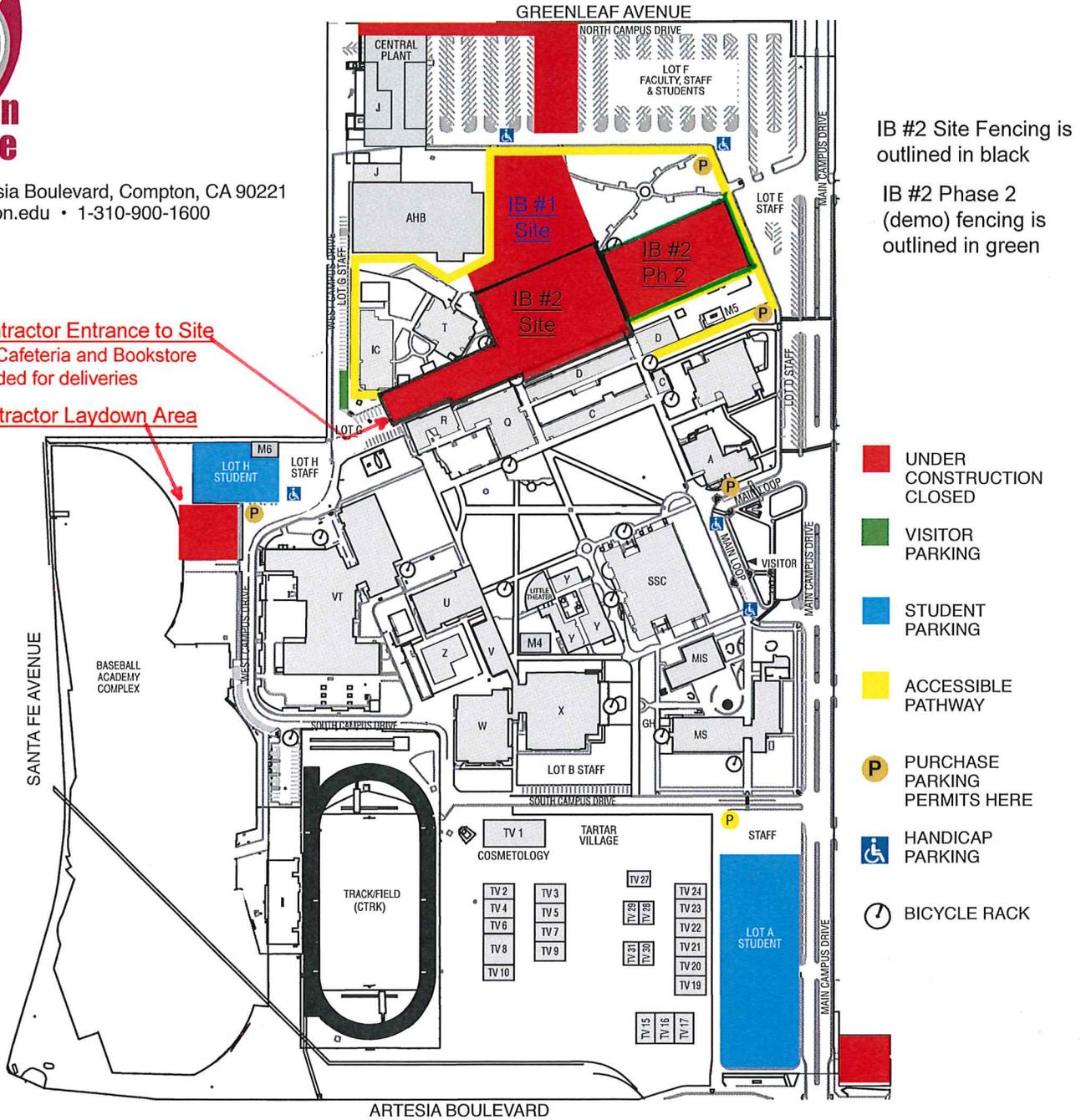
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1111 E. Artesia Boulevard, Compton, CA 90221
www.compton.edu • 1-310-900-1600

IB #2 Contractor Entrance to Site
Access to Cafeteria and Bookstore
to be provided for deliveries

IB #2 Contractor Laydown Area



- IB #2 Site Fencing is outlined in black
- IB #2 Phase 2 (demo) fencing is outlined in green
- UNDER CONSTRUCTION CLOSED
- VISITOR PARKING
- STUDENT PARKING
- ACCESSIBLE PATHWAY
- P PURCHASE PARKING PERMITS HERE
- ♿ HANDICAP PARKING
- 🚲 BICYCLE RACK

COMPTON COLLEGE

<p>A Administration, Admissions & Records, Counseling, Dean of Student Services</p> <p>AHB Allied Health Building, Dean of Student Learning (Health, Natural Sciences & Human Services)</p> <p>C Academic Affairs, Bursar's Office, Business Affairs, Human Resources, Vice President Compton College, Print Shop</p> <p>D Transfer/Career Center</p> <p>E Outreach and School Relations, Assessment Center</p> <p>F Classrooms, Financial Aid, Welcome Center</p> <p>G Classrooms</p> <p>GH Greenhouse</p> <p>IC Child Development Center - Infant/Toddler Building</p> <p>J Maintenance, Tradesman, and Shipping & Receiving</p> <p>MS Math/Science</p> <p>MIS Management Information Systems</p>	<p>M4 St. John's Student Health Center</p> <p>M5 Upward Bound Math & Science</p> <p>M6 Bond Trailer</p> <p>Q Student Lounge, Cafeteria, Faculty & Staff Lounge</p> <p>R Bookstore, Student Life</p> <p>SSC Library - Student Success Center, Dean of Student Success (Humanities & Mathematics)</p> <p>T Abel B. Sykes Jr. Child Development Center</p> <p>U EOPS/CARE</p> <p>V Campus Police Department (V-72), Classrooms</p> <p>VT Dean of Student Learning (Arts, Social Sciences & Career Technical Education) CalWORKs, Special Resource Center (DSPS)</p> <p>W Physical Education, Athletics</p> <p>X Gymnasium, Dance</p> <p>Y Music, Theater Arts</p>
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SECTION 024113 - SELECTIVE SITE DEMOLITION

PART 1- GENERAL

1.1 SUMMARY

A Provisions of the General and Supplementary Conditions and Division One apply to this section.

B Section Includes: Furnishing all labor, materials and equipment necessary for demolition, dismantling, cutting and alterations as indicated, specified, and required for completion of the Contract, as applicable. Includes items such as the following:

- 1 Protecting existing work to remain.
- 2 Cleaning soiled materials that are to remain.
- 3 Disconnecting and capping utilities.
- 4 Removing debris and equipment.
- 5 Removal of items indicated on Drawings.
- 6 Salvageable items to be retained by the Owner as indicated on the Drawings and during the pre-construction job walk.

C Related Sections:

- 1 Section 312000: Earthwork

1.2 QUALITY ASSURANCE

A Comply with the following:

- 1 Applicable codes, ordinances, regulations of local, municipal, state and federal authorities having jurisdiction.
- 2 Comply strictly to Rule 403 Fugitive Dust, South Coast Air Quality Management District.
- 3 Obtain necessary permits and notices, post where required.
- 4 Comply with safety requirements of the local fire department.
- 5 Comply with ANSI A10.6.

B Notify affected utility companies before starting Work and comply with their requirements.

C Carefully perform demolition work, by skilled workers experienced in building demolition procedures, using appropriate tools and equipment. Perform work, at all times, under the direct supervision of a supervisor approved by the Owner Inspector.

D Coordinate demolition with other trades to ensure correct sequence, limits, and methods of proposed demolition. Schedule work to create least possible inconvenience to the public and to facility operations.

- E Pre-Demolition: Conduct conference at Project site 7 days prior to scheduled installation.
 - 1 Conference agenda shall include review and discussion of requirements of authorities having jurisdiction, instructions and requirements of serving utilities, sequencing and interface considerations and Project conditions.
 - 2 Conference shall be attended by supervisory and quality control personnel of Contractor and all subcontractors performing this and directly related work. Submit minutes of meeting to Design Builder's Representative for Project record purposes.

1.3 DEFINITIONS

- A Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the Owner's property.
- B Remove and Salvage: Items indicated to be removed and salvaged remain the Owner's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to location as directed by Owner's Representative.
- C Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in locations indicated.
- D Existing to Remain: Protect construction indicated to remain against damage and soiling during demolition. When permitted by the Owner's Representative, items may be removed to a suitable, protected storage location during demolition and then cleaned and reinstalled in their original locations.
- E Replace: Remove and legally dispose of existing item(s) indicated and install new like item(s) that conform to project specifications.

1.4 OWNERSHIP OF MATERIALS

- A Ownership of Materials: Except for items or materials indicated to be reused, salvaged, or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from the site with further disposition at the Contractor's option.

1.5 PROJECT CONDITIONS

- A Drawings may not indicate in detail all demolition work to be carried out. Carefully examine existing conditions to determine full extent of demolition required. All utilities, whether shown on the drawings or not, to be capped at the property line U.N.O.
- B Repair damage due to demolition activities to existing improvements to remain at no additional cost to the Owner. Repair or replace as directed by the Owner Inspector.
- C Take measures to avoid excessive damage from inadequate or improper means and methods, or improper shoring, bracing or support. Repair or replace any resulting damage at no additional cost to the owner as directed by the Owner Inspector.
- D If conditions are encountered that vary from those indicated, notify the Owner Inspector for instructions prior to proceeding. Owner assumes no responsibility for actual condition of structures to be demolished.

E Inform Owner immediately upon discovery of asbestos products, radioactive materials, toxic wastes or other hazardous materials. Do not remove hazardous materials without Owner authorization.

F Adjacent roadways/passageways:

- 1 Maintain fire department access through all phases of the project.
- 2 Obstruction of streets, walks or other adjacent facilities will not be allowed.

1.6 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.

PART 2- PRODUCTS

2.1 SOIL MATERIALS

A Satisfactory Soil Materials: Soils approved by the testing geotechnical engineer and free of rock or gravel larger than 4 inches in any dimension, debris, waste, vegetation and other deleterious matter and as approved by the Geotechnical Engineer. Rocks or hard lumps larger than approximately 3 inches in diameter should be broken into smaller pieces or should be removed from the site. It is anticipated that most of the on-site soils may be reusable as engineered fill after any vegetation, construction debris, oversized material and deleterious material is removed from the site. On-site soils shall be adequately moisture conditioned to permit achieving the required compaction.

B Backfill & Native Fill Materials: The on-site soils may be reused as compacted engineered fill provided they comply to the requirements of "Satisfactory Soil Materials", as described above.

C 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 Imported materials shall confirm to soils report section 4.1.4 Fill Materials.

D Engineered Fill: Satisfactory Soil Materials / Borrow Fill Material, as described above, placed in lifts no greater than 6 inches thick (loose measurements) and each lift moisture conditioned per soils engineers recommendations. All engineered fill should be densified to a minimum relative compaction of 90 percent per ASTM D 1557.

E Backfill Material for Trenches:

1 The on-site soils may be used for backfilling utility trenches from six inches above the top of storm drain pipes to the surface, provided the material is free of organic matter and deleterious substances. Any soft and/or loose materials or fill encountered at pipe invert should be removed and replaced with properly compacted fill or adequate bedding material. Also, rocks larger than 3 inches and boulders should not be used as backfill.

2.2 HANDLING OF MATERIALS

A Items scheduled for salvage by the Owner shall be delivered to a location designated by the Owner's Authorized Representative. Items shall be cleaned, packaged and labeled for storage.

B Items scheduled for reuse shall be stored on site and protected from damage, soiling and theft.

PART 3- EXECUTION

3.1 GENERAL

A Protection:

- 1 Do not begin demolition until safety partitions, barricades, warning signs and other forms of protection are installed.
- 2 Provide safeguards, including warning signs, lights and barricades, for protection of occupants and the general public during demolition.
- 3 Provide and maintain fire extinguishers. Comply with requirements of governing authorities.
- 4 Maintain existing utilities which are to remain in service and protect from damage during operations.

B Safety: If at any time safety of existing construction appears to be endangered, take immediate measures to correct such conditions; cease operations and immediately notify the Owner Inspector. Do not resume demolition until directed by the Owner Inspector.

C 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

D Dust Control: Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations. Do not create hazardous or objectionable conditions, such as flooding and pollution, when using water.

E Water for Dust Control: Contractor shall obtain and pay for all water required for his dust control operations. 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 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.

F A 6 foot high, chain link fence and gates, shall be erected prior to any demolition operations at the construction limits perimeter. Coordinate the exact location with Owner.

G Debris Removal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level.

H Progress Cleaning: Clean adjacent buildings and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing before start of demolition.

I Where performing contracted scope of work requires coring of existing concrete, brick masonry, or CMU structures (including Walls, Floors, and Sitework), contractor shall obtain and document means of verifying existence and location of embedded steel reinforcing materials within said concrete, brick and CMU assemblies. Contractor shall locate reinforcement by means of non-invasive technology such as X-ray photography for the purposes of protecting said reinforcement in place and shall not damage any reinforcement materials (rebar, etc.) unless specifically detailed as such and approved by the authority having jurisdiction.

J Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

K Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.

L Contractor shall provide temporary weather protection, during interval between demolition and removal of existing construction, on exterior surfaces and new construction to ensure that no water leakage or damage occurs to structure or interior areas.

M Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of building to be selectively demolished.

N Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before start of selective demolition.

O Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials if exposed, repaired surfaces shall match existing adjacent surface color finish and texture.

1 Restore exposed finishes of patched areas and extend finish restoration into adjoining construction to remain in a manner that eliminates evidence of patching and refinishing.

P Disposal: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

3.2 PREPARATION

A Prevent movement or settlement of adjacent structures. Provide bracing and shoring as necessary.

B Utilities:

- 1 The Drawings do not purport to show all below-grade conditions and objects on the site. Contractor shall perform field investigations as necessary to establish location of underground utility services and other features affecting earthwork.
- 2 Mark location of underground utilities on asphalt pavement with paint
- 3 Disconnect and cap utility services; comply with requirement of governing authorities.
- 4 Contractor shall arrange and notify utility company in advance of date and time when service needs to be disconnected.
- 5 Do not commence demolition operations until associated disconnections have been completed.
- 6 Should utilities and other below-grade conditions be encountered which adversely affect the Work, discontinue affected Work and notify Owner's Representative and Architect and request direction. Unforeseen conditions will be resolved in accordance with provisions of the General Conditions of the Contract.
- 7 Should a utility line or structure be damaged, immediately notify the responsible utility company or agency and notify Owner's Representative and Architect.

C Repair or replace all damaged utility lines and structures as directed by the responsible utility company or agency.

D Repair or replacement of damaged utility lines and structures whose location or existence has been made known to the Contractor shall be at no change in the Contract Time and Contract Price.

E Structures to be demolished shall be inspected for hazardous materials. Such materials shall be removed and disposed of before general demolition begins.

F Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by Owner's Representative and Authority Having Jurisdiction (AHJ). Provide temporary services during interruptions to existing utilities, as acceptable to Owner's Representative and to Authority Having Jurisdiction (AHJ).

3.3 EXPLOSIVES

A Explosives: Use of explosives will not be permitted.

3.4 DEMOLITION

A Demolition, General:

- 1 With certain exceptions, the Contractor shall raze, remove and dispose of all buildings and foundations, structures, paving, fences and other obstructions that lie wholly or partially within the construction limits identified on Drawings. The exceptions are utility-owned equipment and any other items the Owner/Documents may direct the Contractor to leave intact or re-use onsite. Cease demolition immediately if adjacent structures appear to be in danger.
- 2 Conduct demolition operations and remove debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

- 3 Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner's Representative and Authority Having Jurisdiction (AHJ). Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
- 4 Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around demolition area.
 - a Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
 - b Protect existing site improvements, appurtenances, and landscaping to remain.
 - c Completely remove below-grade construction, including foundation walls and footings.
- 5 Filling Below-Grade Areas: Completely fill below-grade areas and voids resulting from demolition of buildings and pavements with soil materials according to requirements specified in Section 31 20 00: Earthwork.
- 6 Damages: Promptly repair damages to adjacent facilities caused by demolition operations.
- 7 Unless otherwise indicated on the plans, remove all demolished material from the site and dispose of at approved disposal sites. Comply with all requirements for recycling of demolished material as called for in Division 1 of this Specification. The contractor shall obtain necessary permits for the transportation of material from the site.

3.5 REMOVAL OF EXISTING PLUMBING AND ELECTRICAL EQUIPMENT AND SERVICES

A Remove existing plumbing and electrical equipment fixtures and services not indicated for reuse and not necessary for completion of work. Remove abandoned lines and cap unused portions of existing lines. The Contractor is responsible for completely surveying the site and locating all existing utilities, above and below ground, before contracting to perform the work.

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 Owner 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 Owner 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 Owner 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.

3.6 CLEANING

- A Clean existing materials to remain, using appropriate tools and materials.
- B Protect adjacent materials and equipment during cleaning operations.

3.7 RESTORATION

A Restoration of Site Finishes:

- 1 Concrete paving: Where it is necessary to excavate a trench across make a cut in concrete paved areas, cut concrete cutting saw, full depth of paving.
- 2 Bituminous paving: Where it is necessary to excavate a trench across make a cut in bituminous paved areas, either first score paving with a concrete cutting saw, in neat straight lines, prior to removing paving or make straight cuts with pneumatic spade.
- 3 Restoration of paving: Restore all paved areas to their original condition using material of like type and quality as the removed paving. Paving in public ways shall conform to applicable requirements of authorities having jurisdiction. Repaired surfaces shall match existing adjacent paving except minimum depth shall be 3-1/2 inches where existing paving is less than 3-1/2 inches.
- 4 Restoration of landscape planting: Restore soil and plant materials to match original condition, including additional topsoil, topsoil grading and preparation, new plant materials and plant maintenance during establishment period.

3.8 MAINTENANCE

A Install and maintain all erosion control devices, including sandbag and gravel bag dikes, silt fences, de-silting basins, inlet barricades, vehicle wash traps, and other features called for in the Storm Water Pollution Prevention Plan and Temporary Erosion Control Plans.

3.9 CLEAN-UP/DISPOSAL

- A Coordinate building access with the Owner Inspector. Review and schedule waste storage and removal, include truck access to site.
- B Debris shall be dampened by fog water spray prior to transporting by truck.
- C Debris pick-up area shall be kept broom-clean and shall be washed daily with clean water.
- D Remove waste and debris, other than items to be salvaged. Turn over salvaged items to Owner, or store and protect for reuse where scheduled. Continuously clean-up and remove items as demolition work progresses. Do not allow waste and debris to accumulate in building or on site.

END OF SECTION 024113

SECTION 033543 - POLISHED CONCRETE FINISHING

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. Dye stained concrete interior floor slabs.
- 2. Curing of dye stained concrete.
- 3. Grinding and polishing concrete surfaces.

- B. Related Sections:

- 1. Division 03 Section "Cast-In-Place Concrete" for general applications of concrete and coordination of sample submittal and color selection.
- 2. Division 07 Section "Joint Sealants" for colored sealant for joints.

1.03 REFERENCES

- A. American Concrete Institute (ACI):

- 1. ACI 301 "Specification for Structural Concrete for Buildings."
- 2. ACI 302 IR "Recommended Practice for Concrete Floor and Slab Construction."
- 3. ACI 303.1 "Standard Specification for Cast-In-Place Architectural Concrete."
- 4. ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing of Concrete."
- 5. ACI 305R "Recommended Practice for Hot Weather Concreting."
- 6. ACI 306R "Recommended Practice for Cold Weather Concreting."

- B. American Society for Testing and Materials (ASTM):

- 1. ASTM C309 "Liquid Membrane-Forming Compounds for Curing Concrete."
- 2. ASTM C494 "Standard Specification for Chemical Admixtures for Concrete."

- C. American Association of State Highway and Transportation Officials (AASHTO):

- 1. AASHTO M194 "Chemical Admixtures."

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's complete technical data sheets for the following:

1. Concrete dye stain.
 2. Curing compound.
- B. Design Mixes: For each type of dye stained concrete.
- C. Samples for Initial Selection: Manufacturer's color charts showing full range of colors available.
- D. Qualification Data: For firms indicated in "Quality Assurance" Article, including list of completed projects.
- E. Submit the following in accordance with Division 01 Section "Submittal Procedures."
- F. Product data for each grinding machine, including all types of grinding heads, dust extraction system, joint filler, concrete densifying impregnator, penetrating sealer, and any other chemicals used in the process.
- G. Applicators qualification data.
- H. Polished concrete samples (6): Size 12x12, for each Polished Concrete finish required.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer with experience in the production of specified products.
- B. Installer/Applicator Qualifications: An Installer/Applicator with 5 years experience with work of similar scope and quality.
1. For a list of qualified Installers/Applicators, contact your local Scofield representative or the appropriate Division Office. Western Division: (323) 720-3055.
- C. Comply with the requirements of ACI 301.
- D. Obtain each specified material from same source and maintain high degree of consistency in workmanship throughout Project.
- E. Notification of manufacturer's authorized representative shall be given not less than 1-week before start of Work.
- F. Pre-installation Conference: Conduct conference at project site to comply with requirements in Division 01 Section "Project Management and Coordination."
- G. Provide project names, addresses, contact names, phone numbers of not less than three (3) projects of similar scope completed by the Installer/Applicator.
- H. Installer/Applicator shall be certified by concrete finish equipment and chemical manufacturer and shall provide adequate number of skilled workmen who are thoroughly trained and experienced in the necessary craft.
- I. Manufacturer's Certification: Provide a letter of acknowledgement from both the equipment and chemical manufacturer stating that the Installer/Applicator is a trained applicator and is familiar with proper procedures and installation requirements recommended by the manufacturer.
- J. Mockups:

1. Provide under provisions of Division 01 Section "Quality Control."
2. At location on Project selected by Architect place and finish 10 by 10 feet (3 by 3 m) area for each cut level, shine level, finish coat, and color.
 - a. Cut levels, shine levels, finish coats, and colors are included in schedules cut at the end of Part 3.
3. Construct mockup using processes and techniques intended for use on finished work, including curing procedures. Include samples of control, construction, and expansion joints in sample panels. Mockup shall be produced by the individual workers who will perform the work for the Project.
4. Retain samples of cements, sands, aggregates and color additives used in mockup for comparison with materials used in remaining work.
5. Aggregate selected must be tested to ensure it will accept polish.
6. Edges should be included in mockup.
7. Accepted mockup provides visual standard for finished work.
8. Mockup shall remain through completion of work for use as a quality standard for finished work.
9. Remove mockup when directed.

K. Environmental Limitations:

1. Comply with manufacturer's written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation and other conditions affecting chemical performance.
2. Flatness and Levelness:
 - a. Finish concrete shall have a Floor Flatness rating of not less than 50.
 - b. Finish concrete shall have a Floor Levelness rating of not less than 30.
 - c. Finish concrete shall be cured not less than 28 days or at which point equipment can be put on the slab and does not displace aggregate.
3. Application of finish and dye system shall take place not less than 21 days prior to fixture and trim installation and/or Substantial Completion.
4. Finish concrete area shall be closed to traffic during finish floor application and after application for the time as recommended by the manufacturer.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Surface Concrete Dye Stain: Comply with manufacturer's instructions. Deliver dye stain in original, unopened packaging. Store in dry conditions.

1.07 PROJECT CONDITIONS

A. Environmental Requirements:

1. Schedule placement to minimize exposure to wind and hot sun before curing materials are applied.
2. Avoid placing concrete if rain, snow, or frost is forecast within 24 hours. Protect fresh concrete from moisture and freezing.
3. Comply with professional practices described in ACI 305R and ACI 306R.

- B. Schedule delivery of concrete to provide consistent mix times from batching until discharge. Mix times shall meet manufacturer's written recommendations.

1.08 PRE-JOB CONFERENCE

- A. One week prior to placement of concrete a meeting will be held to discuss the Project and application materials.
- B. It is suggested that the Architect, Landscape Architect, Engineer, General Contractor, Construction Manager, Subcontractor, Ready-Mix Concrete Representative, and a Manufacturer's Representative be present.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Products: Subject to compliance with requirements, provide products by L.M. SCOFIELD COMPANY or comparable products by another manufacturer.

2.02 ACCESSIBILITY REQUIREMENTS

- A. Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.
- B. Polished concrete flooring shall be stable, firm, and slip resistant and shall comply with CBC Section 11B-302 per CBC Section 11B-302.1.

2.03 SUSTAINABILITY REQUIREMENTS

- A. Comply with applicable provisions in the CGBC.
- B. Emissions: Comply with CGBC Section 5.504.4.3. 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.
- C. VOC Content: Interior 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. Floor Coatings: 100 g/L.
- D. Low-Emitting Materials: Floor coatings shall comply with the requirements of authorities having jurisdiction.

2.04 MATERIALS

- A. Solvent based color dye to penetrate concrete surface.
- B. Color Liquid Dye Concentrate Manufactured by L.M. SCOFIELD COMPANY.
- C. Provide manufacturer's companion Lithium Densifier and Guard S product to help ensure accent color.

D. Products:

1. L.M. SCOFIELD COMPANY; Formula One Liquid Dye Concentrate.
2. L.M. SCOFIELD COMPANY; Formula One Lithium Densifier.
3. L.M. SCOFIELD COMPANY; Formula One Guard S.

E. Curing Compound for Dye Stained Concrete:

1. L.M. SCOFIELD COMPANY; LITHOCHROME COLORWAX. Use to cure exterior flatwork that will be allowed to cure naturally with only occasional maintenance.

F. Chemical Hardener/Densifiers Manufactured by L.M. SCOFIELD COMPANY.

1. Materials:

- a. L.M. SCOFIELD COMPANY; Formula One Lithium Densifier, is a high performing hardening and dust proofing compound that is chemically reactive and permanently bonds to concrete formulated to be used in conjunction with integrally colored concrete as well as uncolored concrete.
 - b. L.M. SCOFIELD COMPANY; Formula One Guard S.
2. 3-head or 4-head counter rotating variable speed floor grinding machine with not less than 600 pounds down pressure.
 3. Dust extraction system, pre-separator, and squeegee attachments with flow rating of not less than 322 cubic feet per minute.
 4. Grinding Heads:
 - a. Metal Bonded: 16, 25, 40, 60, 80, 150, and 300 grits.
 - b. Resin Bonded, Phenolic Diamonds: 100, 200, 400, 800, and 1500.
 5. Grinding Pads for Edges:
 - a. Metal Bonded: 40, 60, 100 and 120 grits.
 - b. Resin Bonded, Phenolic Diamonds: 200, 400, 800, and 1500.
 6. Hand grinder with dust extraction equipment and pads.

G. Curing Compound for Polished, Hardened Concrete: L.M. SCOFIELD COMPANY; LITHOCHROME COLORWAX. Use to cure in the same color as the concrete directly after finishing process.

2.05 CONCRETE MIX DESIGN

- A. Minimum Cement Content: 5 sacks per cubic yard of concrete.
- B. Slump of concrete shall be consistent throughout Project at not more than 4 inches. At no time shall slump exceed 5 inches. (If super plasticizers or mid-range water reducers are allowed, slump shall not exceed 8 inches).
- C. Do not add calcium chloride to mix as it causes mottling and surface discoloration.
- D. Supplemental admixtures shall not be used unless approved by manufacturer.

- E. Do not add water to the mix in the field.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install concrete according to requirements of Division 03 Section "Cast-In-Place Concrete."
- B. Do not add water to concrete mix in the field.
- C. Surfaces shall be finished uniformly with the following finish:
 - 1. Ground and Polished Concrete Surface: Precautions should be taken to insure the surface is in tolerances to perform this function.

3.02 POLISHED CONCRETE APPLICATION

- A. Applicator shall examine the areas and conditions under which work of this section will be provided and the conditions detrimental to the timely and proper completion of the work shall be corrected and the Applicator shall not proceed until unsatisfactory conditions are resolved.
- B. Grind the concrete floor to within 2 to 3 inches of walls with 16, 25, 40, 60, 80 and/or 150 grit removing construction debris, floor slab imperfections, and until there is a uniform scratch pattern and desired concrete aggregate exposure.
- C. Apply material approved by Architect for color effects in accordance with the Contract Documents and the manufacturer's recommended guidelines.
- D. Fill construction joints and cracks with filler products as specified in accordance with manufacturer's instructions colored to match (or contrast) with concrete color as specified by Architect.
- E. Apply densifying impregnator undiluted at approximately 200 square feet per gallon using a stiff, long bristled broom. Cover the entire area liberally. Using a broom, work the densifier into the substrate for 30 minutes. During this 30 minute period, continually keep the substrate wet with densifier. Squeegee excess material off the floor. Allow 12 to 24 hours for full cure.
- F. Grind the floor to within 2 to 3 inches of walls with metal bonded diamond grits of 150 and 300; grinding 90 degrees from each previous grind and removing all the scratches from the previous grit. Vacuum the floor thoroughly after each grind using a squeegee vacuum attachment.
- G. Grind the edges with 40, 60, 120, and 220 grit grinding pads removing all of the scratches from the previous grit. Vacuum the floor thoroughly after each grind using a squeegee vacuum attachment.
- H. Polish the floor, to desired sheen level, with phenolic resin bonded diamond grits of 100, 400, 800, and 1500; first polishing the edges, unless otherwise indicated, with pads of the same grit and then the field of the floor removing all scratches from the previous grit. After each polish, clean the floor thoroughly using clean water and an auto scrubber or a mop and a wet vacuum.
- I. Apply dye to surface after 400 resin bond grind. Allow dye to dry to touch.

- J. After the dye has dried, apply densifier at a rate of 300 square feet per gallon. Using a broom, work the material into the floor for not less than 10 minutes. Tight squeegee the remaining material from the floor without leaving squeegee marks or puddles. Allow to cure for 12 to 24 hours.
- K. Polish with 800 resin bond grind.
- L. Apply Guard S at 750 square feet per gallon.
- M. Using a high speed (2000 to 3000 rpm) burnishing machine and hogs hair burnishing pad, buff the surface to a high shine.
- N. Upon completion, the work shall be ready for final inspection and acceptance by the customer.

3.03 CURING

- A. Concrete: Apply curing and sealing compound for 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.
- B. Curing compound shall be same color as the colored concrete and supplied by same manufacturer of the colored admixture.
- C. 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.
- D. Do not cover concrete with plastic sheeting.

3.04 CLEANING

- A. The work area shall be kept clean and free of debris at all times.
- B. Remove slurry and dust from adjoining surfaces as necessary.
- C. Dispose of material containers in accordance with local regulations.
- D. Protect finished work until fully cured per manufacturer's recommendations.

3.05

3.06 SCHEDULE

- A. Cut Level (Depth of Cut):
 - 1. Grade 1: Cream finish.
- B. Shine Level:

1. Class 2: 800 grit polish.
- C. Polished Concrete Finish Coat:
1. At a distance of 100 feet, the floor will reflect images from side lighting.
- D. Color(s):
1. As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.

END OF SECTION 033543

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.

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. Tothing 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 $\frac{1}{4}$ part but not more than $\frac{1}{2}$ 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 $\frac{3}{4}$ -inch, plus or minus $\frac{1}{4}$ 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 $\frac{1}{4}$ -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:

<u>ITEM</u>	<u>7 days</u>	<u>28 days</u>
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

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. Colors: Match Architect's samples.

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 inturred 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

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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 and 2.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Rmax, Inc; TSX-8500 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. Hunter Panels.
 - g. Johns Manville; a Berkshire Hathaway company.
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

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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 IV, fabric reinforced, felt or fleece backed.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Tremco; TPA FB Single Ply Roof System, Polyester Fleece Backed Tri Polymer Alloy, Thermoplastic Single Ply Roof System, or a comparable product by another manufacturer.
2. Minimum Thickness, Less Felt Backing, ASTM D 751: Not less than 60 mils (1.5 mm).
3. Exposed Face Color: Tan.
4. Initial/3-Year Aged Reflectance ASTM C 1549: 0.83/0.65.
5. Initial/3-Year Aged Thermal Emittance ASTM C 1371: 0.80/0.79.
6. Initial/3-Year Aged Solar Reflectance Index (SRI) ASTM E 1980: 108/84.

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. 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.

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. Compressive Strength: 25 psi (172 kPa).
 - 2. Thickness: Not less than that required to achieve R-30 or as indicated on Drawings.
- C. Tapered Insulation: Provide factory-tapered insulation boards.
 - 1. Material: Match roof insulation.
 - 2. Minimum Thickness: 1/4 inch (6.35 mm).
 - 3. 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. 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. 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

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SECTION 083473.13 - METAL SOUND CONTROL DOOR 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 metal sound control door assemblies.
- B. Related Requirements:
 - 1. Section 08473.16 "Wood Sound Control Door Assemblies" for sound control assemblies with wood doors and steel frames.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

- A. Coordinate installation of anchorages for sound control door assemblies. Furnish setting drawings, templates, and directions for installing anchorages. Deliver sleeves, inserts, anchor bolts, and items with integral anchors to Project site in time for installation.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review procedures for coordinating frame and anchor installation with wall construction.
 - 2. Review required field quality-control procedures.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include sound ratings, construction details, material descriptions, core descriptions, fire-resistance rating, temperature-rise ratings, and finishes.
- B. Shop Drawings: For sound control door assemblies.
 - 1. Include elevations of each door design.

2. Include details of sound control seals, door bottoms, and thresholds.
3. Include details of doors, including vertical- and horizontal-edge details and metal thicknesses.
4. Include details of frame for each frame type, including dimensioned profiles and metal thicknesses.
5. Include locations of reinforcements and preparations for hardware.
6. Include details of each different wall opening condition.
7. Include details of anchorages, joints, field splices, and connections.
8. Include details of accessories.
9. Include details of moldings, removable stops, and glazing.
10. Include details of conduits and preparations for power, signal, and control systems.

- C. Schedule: Provide a schedule of sound control door assemblies prepared using same reference numbers for details and openings as those on Drawings. Coordinate with the Door Hardware Schedule.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, manufacturer, and acoustical testing agency.
- B. 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.
- C. Product Certificates: For each type of sound control door assembly.
- D. Product Test Reports: For each sound control door assembly, for tests performed by a qualified testing agency.
- E. Field quality-control reports.
- F. Sample Warranty: For manufacturer's special warranties.

1.8 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sound control door assemblies to include in maintenance manuals.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Acoustical Testing Agency Qualifications: An independent agency accredited as an acoustical laboratory according to the National Voluntary Laboratory Accreditation Program of NIST.
- C. 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.

D. 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 doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Avoid the use of nonvented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store 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.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of sound control door assemblies that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Failure to meet sound rating requirements.
 - b. Faulty operation of sound seals.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use or weathering.
 2. Warranty Period: Five years from date of Substantial Completion.

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. Ambico Limited.
 2. Amweld International, LLC.
 3. Ceco Door; ASSA ABLOY.
 4. Curries Company; ASSA ABLOY.
 5. Firedoor Corporation.
 6. Fleming Door Products Ltd.; Assa Abloy Group Company.
 7. IAC Acoustics.
 8. Krieger Specialty Products Company.
 9. Noise Barriers, LLC.
 10. Overly Door Company.
 11. Pioneer Industries.

12. Security Acoustics.

- B. Source Limitations: Obtain steel sound control door assemblies, including doors, frames, sound control seals, hinges, thresholds, and other items essential for sound control, 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-404.2.9, 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-404.2.9, 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. Sound Rating: Provide sound control door assemblies identical to those of assemblies tested as sound-retardant units by an acoustical testing agency, and have the following minimum rating:
 - 1. STC Rating: Not less than 55 as calculated by ASTM E413 when tested in an operable condition according to ASTM E90.
- B. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Smoke- and Draft Control Assemblies: Provide an assembly with gaskets 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.

2.4 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 STEEL SOUND CONTROL DOORS

A. Doors: Flush-design sound control doors, thickness as required to provide STC rating, but not less than 1-3/4 inches (44 mm) thick, of seamless construction; with manufacturer's standard sound-retardant core as required to provide STC and fire rating indicated. Construct doors with smooth, flush surfaces without visible joints or seams on exposed faces or stile edges. Fabricate according to NAAMM-HMMA 865.

1. Exterior Doors: Fabricate from metallic-coated steel sheet, thickness as required to provide STC rating, but not less than 0.053 inch (1.34 mm) thick (16 gage nominal), with not less than G60 or A60 (ZF180) coating.
2. Core: Manufacturer's standard sound control core.
3. Top and Bottom Channels: Closed with continuous channels of same material as face sheets, spot welded to face sheets not more than 6 inches (152 mm) o.c.
4. Hardware Reinforcement: Same material as face sheets.

B. Materials:

1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
2. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
3. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B, with G60 (ZF180) zinc (galvanized) or A60 (ZF180) zinc-iron-alloy (galvannealed) coating designation.

C. Finishes:

1. Prime Finish for Exterior Doors and Frames: Zinc-rich primer.
 - a. Basis-of-Design Product: Subject to compliance with requirements, provide Tnemec Company, Inc.; Series 94-H2O Hydro-Zinc, or comparable product by another manufacturer.
 - 1) Apply at a dry film thickness of not less than 2.5 to 3.5 mils (0.0635 to 0.0889 mm).

2.7 SOUND CONTROL FRAMES

A. Frames: Fabricate sound control door frames with corners mitered, reinforced, and continuously welded the full depth and width of frame. Fabricate according to NAAMM-HMMA 865.

1. Weld frames according to NAAMM-HMMA 820.
2. Exterior Frames: Fabricate from metallic-coated steel sheet, thickness as required to provide STC rating, but not less than 0.053 inch (1.34 mm) thick (16 gage nominal), with not less than G60 or A60 (ZF180) coating.
3. Hardware Reinforcement: Fabricate according to NAAMM-HMMA 865 of same material as face sheets.

4. Jamb Anchors:
 - a. Stud-Wall Type: Designed to engage stud, welded to back of frames, not less than 0.042 inch (1.06 mm) thick (18 gage nominal), uncoated steel unless otherwise indicated.
5. Floor Anchors: Not less than 0.067 inch (1.70 mm) thick (14 gage nominal), metallic-coated steel, and as follows:
 - a. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

B. Materials:

1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
2. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
3. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B, with G60 (ZF180) zinc (galvanized) or A60 (ZF180) zinc-iron-alloy (galvannealed) coating designation.
4. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A153/A153M, Class B.
5. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A153/A153M or ASTM F2329.
6. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers.

C. Finishes:

1. Prime Finish for Exterior Doors and Frames: Zinc-rich primer.
 - a. Basis-of-Design Product: Subject to compliance with requirements, provide Tnemec Company, Inc.; Series 94-H2O Hydro-Zinc, or comparable product by another manufacturer.
 - 1) Apply at a dry film thickness of not less than 2.5 to 3.5 mils (0.0635 to 0.0889 mm).

2.8 HARDWARE

- A. Sound Control Door Hardware: Manufacturer's standard sound control system, including head and jamb seals, door bottoms, and thresholds, as required by testing to achieve STC and fire rating indicated.
1. Head and Jamb Seals: One of the following:
 - a. Neoprene Compression Seals: One-piece units consisting of closed-cell sponge neoprene seal held in place by metal retainer, with retainer cover of same material as door frame; attached to door frame with concealed screws.
 - b. Silicone Compression Seals: One-piece units consisting of silicone compression bulb and stabilizer flange; attached to door frame adhesively.
 - c. Magnetic Seals: One-piece units consisting of closed-cell sponge neoprene seal and resiliently mounted magnet held in place by metal retainer, with retainer cover of same material as door frame; attached to door frame with concealed screws.
 2. Automatic Door Bottoms: Neoprene or silicone gasket, held in place by metal housing, that automatically drops to form seal when door is closed; mounted to bottom edge of door with screws.

- a. Mounting: Mortised or semimortised into bottom of door as required by testing to achieve STC rating indicated.
3. Thresholds: Flat, smooth, unfluted type as recommended by manufacturer; fabricated from aluminum.
 - a. Finish: Mill.

B. Other Hardware: Comply with requirements in Section 087100 "Door Hardware."

2.9 FABRICATION

A. Steel Sound Control Door Fabrication: Sound control doors to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal.

1. Comply with requirements in NFPA 80 for fire-rated and smoke control doors.
2. Comply with requirements in NFPA 105 for smoke control doors.
3. Seamless Edge Construction: Fabricate doors with faces joined at vertical edges by welding; welds shall be ground, filled, and dressed to make them invisible and to provide a smooth, flush surface.
4. Exterior Doors: Close top edges flush and seal joints against water penetration. Provide weep-hole openings in bottom of exterior doors to permit moisture to escape.
5. Hardware Preparation: Factory prepare sound control doors to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping.
 - a. Reinforce doors to receive nontemplated mortised and surface-mounted door hardware.
 - b. Locate door hardware as indicated, or if not indicated, according to NAAMM-HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."

6. Tolerances: Fabricate doors to tolerances indicated in NAAMM-HMMA 865.

B. Sound Control Frame Fabrication: Fabricate sound control frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

1. Comply with requirements in NFPA 80 for fire-rated and smoke control doors.
2. Comply with requirements in NFPA 105 for smoke control doors.
3. Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated from same thickness metal as frames.
4. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
5. Floor Anchors: Weld anchors to bottom of jambs and mullions with not less than four spot welds per anchor.
6. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches (1524 mm) in height.
 - 2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) in height.
 - 3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) in height.

- 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm), or fraction thereof, more than 96 inches (2438 mm) in height.
 - 5) Two anchors per head for frames more than 42 inches (1066 mm) wide and mounted in metal-stud partitions.
7. Hardware Preparation: Factory prepare sound control frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping.
- a. Reinforce frames to receive nontemplated mortised and surface-mounted door hardware.
 - b. Locate hardware as indicated, or if not indicated, according to NAAMM-HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."
8. Tolerances: Fabricate frames to tolerances indicated in NAAMM-HMMA 865.

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.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations of sound control door frame connections before frame installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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.
- B. Prior to installation, adjust and securely brace sound control door frames to the following tolerances:
 1. 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.
 2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 3. 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.
 4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install sound control door assemblies plumb, rigid, properly aligned, and securely fastened in place; comply with manufacturer's written instructions.

- B. Frames: Install sound control door frames in sizes and profiles indicated.
1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-rated openings, install frames according to NFPA 80.
 - b. At openings requiring smoke and draft control, install frames according to NFPA 105.
 - c. Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, and dress; make splice smooth, flush, and invisible on exposed faces.
 - d. Remove temporary braces only after frames or bucks have been properly set and secured.
 - e. Check squareness, twist, and plumbness of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 3. Metal-Stud Partitions: Fully fill frames with mineral-fiber insulation.
 4. Installation Tolerances: Adjust sound control door frames for squareness, alignment, twist, and plumbness 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 on a perpendicular line from head to floor.
- C. Doors: Fit sound control doors accurately in frames, within clearances indicated below. Shim as necessary.
1. Non-Fire-Rated Doors: Fit non-fire-rated doors accurately in frames with the following clearances:
 - a. Jambs: 1/8 inch (3 mm).
 - b. Head with Butt Hinges: 1/8 inch (3 mm).
 - c. Sill: Manufacturer's standard.
 - d. Between Edges of Pairs of Doors: 1/8 inch (3 mm).
 2. Fire-Rated Doors: Install fire-rated doors with clearances according to NFPA 80.
 3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.
- D. Sound Control Seals: Where seals have been factory prefit and preinstalled and subsequently removed for shipping, reinstall seals and adjust according to manufacturer's written instructions.
- E. Thresholds: Set thresholds in full bed of sealant complying with requirements in Section 079200 "Joint Sealants."
- F. Special Precautions:
1. The seals shall be installed so that they are in contact with the entire length of the jambs and head.

2. Where pairs of doors are specified, astragals shall be installed so that they are in contact with the entire length of the opposing door leaf. If manufacturer's instructions require astragal seals on both the interior and exterior sides of the door, both astragals shall be provided.
3. The threshold seal shall be installed so that it is in contact with a smooth (not ribbed) surface of the threshold for the entire length of the threshold.
4. No gaps shall occur at the joint between the head and jamb seals, nor between jamb and threshold seals.

3.4 FIELD QUALITY CONTROL

- A. Upon completion of installation, and prior to acceptance by Owner, secure a visit to the job site by a qualified representative of the manufacturer of the acoustical door system(s) to confirm that installation is in conformance with the manufacturer's recommendations.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Testing Services: Perform testing for verification that assembly complies with STC rating requirements.
 1. Acoustical testing and inspecting agency shall test all sound control door assemblies.
 2. Field tests shall be conducted according to ASTM E336, with results calculated according to ASTM E413. Acceptable field NIC values shall be within 5 dB of laboratory STC values.
 3. Inspection Report: Acoustical testing agency shall submit report in writing to Architect and Contractor within 24 hours after testing.
 4. If tested door fails, replace or rework all sound control door assemblies to bring them into compliance at Contractor's expense.
 - a. Additional testing and inspecting at Contractor's expense will be performed to determine if replaced or additional work complies with specified requirements.
- D. Prepare test and inspection reports.
- E. 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.
 3. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
 4. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
 5. 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 AND CLEANING

- 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 adjust seals, door bottoms, and other sound control hardware items right before final inspection. Leave work in complete and proper operating condition.
- C. Operation: Rehang or replace doors that do not swing or operate freely.
- D. Remove and replace defective work, including defective or damaged sound seals and doors and frames that are warped, bowed, or otherwise unacceptable.
1. Adjust gaskets, gasket retainers, and retainer covers to provide contact required to achieve STC rating.
- E. 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).
- F. Metallic-Coated Surfaces: Clean abraded areas of doors and repair with galvanizing repair paint according to manufacturer's written instructions.

3.6 DEMONSTRATION

- A. Instruct the Owner's maintenance personnel regarding operation and maintenance of all acoustic doors.

END OF SECTION 083473.13

SECTION 083473.16 - WOOD SOUND CONTROL DOOR 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 wood sound control door assemblies.
- B. Related Requirements:
 - 1. Section 08473.13 "Metal Sound Control Door Assemblies" for sound control assemblies with steel doors and steel frames.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

- A. Coordinate installation of anchorages for sound control door assemblies. Furnish setting drawings, templates, and directions for installing anchorages. Deliver sleeves, inserts, anchor bolts, and items with integral anchors to Project site in time for installation.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review procedures for coordinating frame and anchor installation with wall construction.
 - 2. Review required field quality-control procedures.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include sound ratings, construction details, material descriptions, core descriptions, fire-resistance rating, temperature-rise ratings, and finishes.
- B. Shop Drawings: For sound control door assemblies.
 - 1. Include elevations of each door design.

2. Include details of sound control seals, door bottoms, and thresholds.
3. Include details of doors, including vertical- and horizontal-edge details and metal thicknesses.
4. Include details of frame for each frame type, including dimensioned profiles and metal thicknesses.
5. Include locations of reinforcements and preparations for hardware.
6. Include details of each different wall opening condition.
7. Include details of anchorages, joints, field splices, and connections.
8. Include details of accessories.
9. Include details of moldings, removable stops, and glazing.
10. Include details of conduits and preparations for power, signal, and control systems.

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. Frames for light openings, 6 inches (150 mm) long, for each material, type, and finish required.

D. Schedule: Provide a schedule of sound control door assemblies prepared using same reference numbers for details and openings as those on Drawings. Coordinate with the Door Hardware Schedule.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, manufacturer, and acoustical testing agency.
- B. 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.
- C. Product Certificates: For each type of sound control door assembly.
- D. Product Test Reports: For each sound control door assembly, for tests performed by a qualified testing agency.
- E. Field quality-control reports.
- F. Sample Warranty: For manufacturer's special warranties.

1.8 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sound control door assemblies to include in maintenance manuals.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Acoustical Testing Agency Qualifications: An independent agency accredited as an acoustical laboratory according to the National Voluntary Laboratory Accreditation Program of NIST.
- C. 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.
- D. 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.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Avoid the use of 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 doors and frames vertically under cover at Project site with head up. Place 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.

1.11 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install wood sound control 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.

1.12 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of sound control door assemblies that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to meet sound rating requirements.
 - b. Faulty operation of sound seals.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use or weathering.

- d. Delamination of veneer.
 - e. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42 by 84 inch (1067 by 2134 mm) section.
 - f. 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: Two years from date of Substantial Completion.

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. Ambico Limited.
 2. Eggers Industries.
 3. Krieger Specialty Products Company.
 4. Marshfield DoorSystems, Inc.
 5. Overly Door Company.
 6. Security Acoustics.
 7. Vancouver Door Company.
- B. Source Limitations: Obtain wood sound control door assemblies, including doors, frames, sound control seals, hinges, thresholds, and other items essential for sound control, 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-404.2.9, 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-404.2.9, 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. Sound Rating: Provide sound control door assemblies identical to those of assemblies tested as sound-retardant units by an acoustical testing agency, and have the following minimum rating:
 1. STC Rating: Not less than 55 as calculated by ASTM E413 when tested in an operable condition according to ASTM E90.
- B. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 1. Smoke- and Draft Control Assemblies: Provide an assembly with gaskets 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.

2.4 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.
- 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.

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.
 - G. Adhesives: Do not use adhesives that contain urea formaldehyde.
 - H. Low-Emitting Materials: Composite wood products shall be made without urea formaldehyde.
 - I. Low-Emitting Materials: Adhesives shall comply with the requirements of authorities having jurisdiction.
 - J. Low-Emitting Materials: Paints and coatings shall comply with the requirements of authorities having jurisdiction.
- 2.6 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.
- 2.7 WOOD SOUND CONTROL DOORS
- A. Doors: Flush-design wood sound control doors, thickness as required to provide STC rating, but not less than 1-3/4 inches (44 mm) thick; with manufacturer's standard sound-retardant core as required to provide STC and fire rating indicated. Fabricate according to WDMA 1.S.1-A.
 - B. Materials: Comply with Section 081416 "Flush Wood Doors" for grade, faces, veneer matching, fabrication, finishing, and other requirements unless otherwise indicated.
 1. Glazing: As required by wood sound control door assembly manufacturer to comply with sound control and fire-rated-door labeling requirements.
 - C. Finishes:
 1. Factory finish wood sound control doors to match doors specified in Section 081416 "Flush Wood Doors."
- 2.8 SOUND CONTROL FRAMES
- A. Frames: Fabricate sound control door frames with corners mitered, reinforced, and continuously welded the full depth and width of frame. Fabricate according to NAAMM-HMMA 865.
 1. Weld frames according to NAAMM-HMMA 820.

2. Interior Frames: Fabricate from metallic-coated steel sheet, thickness as required to provide STC rating, but not less than 0.053 inch (1.34 mm) thick (16 gage nominal), with not less than G40 or A40 (ZF120) coating.
3. Hardware Reinforcement: Fabricate according to NAAMM-HMMA 865 of same material as face sheets.
4. Jamb Anchors:
 - a. Stud-Wall Type: Designed to engage stud, welded to back of frames, not less than 0.042 inch (1.06 mm) thick (18 gage nominal), uncoated steel unless otherwise indicated.
 - b. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter, metallic-coated steel bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
5. Floor Anchors: Not less than 0.067 inch (1.70 mm) thick (14 gage nominal) metallic-coated steel, and as follows:
 - a. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

B. Materials:

1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
2. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
3. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B, with G40 (Z120) zinc (galvanized) or A40 (ZF120) zinc-iron-alloy (galvannealed) coating designation.
4. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A153/A153M, Class B.
5. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A153/A153M or ASTM F2329.
6. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers.

C. Finishes:

1. Prime Finish for Interior Frames: Clean, pretreat, and apply manufacturer's standard primer.
 - a. 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.

2.9 HARDWARE

- A. Sound Control Door Hardware: Manufacturer's standard sound control system, including head and jamb seals, door bottoms, and thresholds, as required by testing to achieve STC and fire rating indicated.
 1. Head and Jamb Seals: One of the following:
 - a. Neoprene Compression Seals: One-piece units consisting of closed-cell sponge neoprene seal held in place by metal retainer, with retainer cover of same material as door frame; attached to door frame with concealed screws.

- b. Silicone Compression Seals: One-piece units consisting of silicone compression bulb and stabilizer flange; attached to door frame adhesively.
 - c. Magnetic Seals: One-piece units consisting of closed-cell sponge neoprene seal and resiliently mounted magnet held in place by metal retainer, with retainer cover of same material as door frame; attached to door frame with concealed screws.
2. Automatic Door Bottoms: Neoprene or silicone gasket, held in place by metal housing, that automatically drops to form seal when door is closed; mounted to bottom edge of door with screws.
- a. Mounting: Mortised or semimortised into bottom of door as required by testing to achieve STC rating indicated.
3. Thresholds: Flat, smooth, unfluted type as recommended by manufacturer; fabricated from aluminum.
- a. Finish: Mill.
- B. Other Hardware: Comply with requirements in Section 087100 "Door Hardware."

2.10 SOUND CONTROL ACCESSORIES

- A. Glazing: Manufacturers' standard factory-installed glazing. Comply with requirements in Section 088000 "Glazing."

2.11 FABRICATION

- A. Wood Sound Control Door Fabrication: Factory fit doors to suit frame-opening sizes indicated, with uniform clearances and bevels according to WDMA I.S.1-A unless otherwise indicated. Comply with final door hardware schedules and hardware templates.
 - 1. Comply with requirements in NFPA 80 for fire-rated and smoke control doors.
 - 2. Comply with requirements in NFPA 105 for smoke control doors.
 - 3. Glazed Lites: Factory install glazed lites according to requirements of tested assembly to achieve STC rating indicated.
 - 4. Hardware Preparation: Factory machine doors for hardware that is not surface applied
 - a. Locate door hardware as indicated, or if not indicated, according to DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
 - b. Coordinate measurements of hardware mortises in steel frames to verify dimensions and alignment before factory machining.
- B. Sound Control Frame Fabrication: Fabricate sound control frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
 - 1. Comply with requirements in NFPA 80 for fire-rated and smoke control doors.
 - 2. Comply with requirements in NFPA 105 for smoke control doors.

3. Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated from same thickness metal as frames.
4. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
5. Floor Anchors: Weld anchors to bottom of jambs and mullions with not less than four spot welds per anchor.
6. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches (1524 mm) in height.
 - 2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) in height.
 - 3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) in height.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm), or fraction thereof, more than 96 inches (2438 mm) in height.
 - 5) Two anchors per head for frames more than 42 inches (1066 mm) wide and mounted in metal-stud partitions.
7. Hardware Preparation: Factory prepare sound control frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping.
 - a. Reinforce frames to receive nontemplated mortised and surface-mounted door hardware.
 - b. Locate door hardware as indicated, or if not indicated, according to DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
8. Tolerances: Fabricate frames to tolerances indicated in NAAMM-HMMA 865.

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.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations of sound control door frame connections before frame installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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.
- B. Prior to installation, adjust and securely brace sound control door frames to the following tolerances:

1. 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.
 2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 3. 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.
 4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install sound control door assemblies plumb, rigid, properly aligned, and securely fastened in place; comply with manufacturer's written instructions.
- B. Frames: Install sound control door frames in sizes and profiles indicated.
1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-rated openings, install frames according to NFPA 80.
 - b. At openings requiring smoke and draft control, install frames according to NFPA 105.
 - c. Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, and dress; make splice smooth, flush, and invisible on exposed faces.
 - d. Remove temporary braces only after frames or bucks have been properly set and secured.
 - e. Check squareness, twist, and plumbness of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 3. Metal-Stud Partitions: Fully fill frames with mineral-fiber insulation.
 4. Installation Tolerances: Adjust sound control door frames for squareness, alignment, twist, and plumbness 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 on a perpendicular line from head to floor.
- C. Doors: Fit sound control doors accurately in frames, within clearances indicated below. Shim as necessary.
1. Non-Fire-Rated Doors: Fit non-fire-rated doors accurately in frames with the following clearances:
 - a. Jambs: 1/8 inch (3 mm).

- b. Head with Butt Hinges: 1/8 inch (3 mm).
 - c. Sill: Manufacturer's standard.
 - d. Between Edges of Pairs of Doors: 1/8 inch (3 mm).
2. Fire-Rated Doors: Install fire-rated doors with clearances according to NFPA 80.
 3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.
- D. Sound Control Seals: Where seals have been factory prefit and preinstalled and subsequently removed for shipping, reinstall seals and adjust according to manufacturer's written instructions.
- E. Thresholds: Set thresholds in full bed of sealant complying with requirements in Section 079200 "Joint Sealants."
- F. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with sound control door assembly manufacturer's written instructions.
1. Secure stops 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.
- G. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.
- H. Special Precautions:
1. The seals shall be installed so that they are in contact with the entire length of the jambs and head.
 2. Where pairs of doors are specified, astragals shall be installed so that they are in contact with the entire length of the opposing door leaf. If manufacturer's instructions require astragal seals on both the interior and exterior sides of the door, both astragals shall be provided.
 3. The threshold seal shall be installed so that it is in contact with a smooth (not ribbed) surface of the threshold for the entire length of the threshold.
 4. No gaps shall occur at the joint between the head and jamb seals, nor between jamb and threshold seals.

3.4 FIELD QUALITY CONTROL

- A. Upon completion of installation, and prior to acceptance by Owner, secure a visit to the job site by a qualified representative of the manufacturer of the acoustical door system(s) to confirm that installation is in conformance with the manufacturer's recommendations.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Testing Services: Perform testing for verification that assembly complies with STC rating requirements.
1. Acoustical testing and inspecting agency shall test all sound control door assemblies.
 2. Field tests shall be conducted according to ASTM E336, with results calculated according to ASTM E413. Acceptable field NIC values shall be within 5 dB of laboratory STC values.
 3. Inspection Report: Acoustical testing agency shall submit report in writing to Architect and Contractor within 24 hours after testing.
 4. If tested door fails, replace or rework all sound control door assemblies to bring them into compliance at Contractor's expense.

- a. Additional testing and inspecting at Contractor's expense will be performed to determine if replaced or additional work complies with specified requirements.
- D. Prepare test and inspection reports.
- E. 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.
 4. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
 5. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
 6. 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 AND CLEANING

- 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 adjust seals, door bottoms, and other sound control hardware items right before final inspection. Leave work in complete and proper operating condition.
- C. Operation: Rehang or replace doors that do not swing or operate freely.
- D. Remove and replace defective work, including defective or damaged sound seals and doors and frames that are warped, bowed, or otherwise unacceptable.
1. Adjust gaskets, gasket retainers, and retainer covers to provide contact required to achieve STC rating.
- E. Touchup Painting for Interior 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.
- F. Metallic-Coated Surfaces: Clean abraded areas of frames and repair with galvanizing repair paint according to manufacturer's written instructions.

3.6 DEMONSTRATION

- A. Instruct the Owner's maintenance personnel regarding operation and maintenance of all acoustic doors.

END OF SECTION 083473.16

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-404.2.9, 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-404.2.9, 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 EXTERIOR STOREFRONT SYSTEMS

- A. DSA Reviewed and Approved Basis-of-Design Product: Subject to compliance with requirements, provide Arcadia, Inc.; TC470 Series, 2-1/4 inch by 4-1/2 inch, Thermally Broken, Offset Glazed System, for 1 inch Glass, or a comparable product by another manufacturer.
- B. Substitution Limitations:
1. The proposed substitution may or may not be accepted after Architect's and Owner's review for content and schedule impact.
 2. The proposed substitution may or may not be accepted, based on Architect's and Owner's review and approval, for submittal to DSA.
 - a. Architect's and Owner's approval is required prior to DSA submittal.
 - b. DSA approval is required prior to fabrication and installation.
 3. The proposed substitution shall include all costs for redesign with consequential changes by other trades along with the Architect and related approvals by governing agencies.
 - a. Revisions to shop drawings illustrating the proposed changes are not considered adequate for DSA review and approval.
 - b. A fee of not less than \$10,000.00 for Architects time to review the proposed substitution prior to submitting for DSA approval shall be included.
 - c. A fee of not less than \$10,000.00 for DSA review processing by the Architect shall be included.
 - d. Fee amounts are minimums. Fees are subject to increase pending Architect and Agency reviews of the proposed substitution.
 4. If proposed substitution is not reviewed and approved by DSA in a timely manner, then manufacturer and Installer shall be subject to time and material back charge for delays in the project.
- C. 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.
- D. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- E. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.6 VERTICAL SUNSHADES

- A. DSA Reviewed and Approved Basis-of-Design Product: Subject to compliance with requirements, provide Arcadia, Inc.; Brise Soleil Design Series, Custom Sun Shade Shapes, BSD009, or a comparable product by another manufacturer.
- B. Substitution Limitations:
1. The proposed substitution may or may not be accepted after Architect's and Owner's review for content and schedule impact.
 2. The proposed substitution may or may not be accepted, based on Architect's and Owner's review and approval, for submittal to DSA.
 - a. Architect's and Owner's approval is required prior to DSA submittal.
 - b. DSA approval is required prior to fabrication and installation.
 3. The proposed substitution shall include all costs for redesign with consequential changes by other trades along with the Architect and related approvals by governing agencies.
 - a. Revisions to shop drawings illustrating the proposed changes are not considered adequate for DSA review and approval.
 - b. A fee of not less than \$10,000.00 for Architects time to review the proposed substitution prior to submitting for DSA approval shall be included.
 - c. A fee of not less than \$10,000.00 for DSA review processing by the Architect shall be included.
 - d. Fee amounts are minimums. Fees are subject to increase pending Architect and Agency reviews of the proposed substitution.
 4. If proposed substitution is not reviewed and approved by DSA in a timely manner, then manufacturer and Installer shall be subject to time and material back charge for delays in the project.

2.7 HORIZONTAL SUNSHADES

- A. DSA Reviewed and Approved Basis-of-Design Product: Subject to compliance with requirements, provide Arcadia, Inc.; Brise Soleil Design Series, Custom Sun Shade Shapes, BSD001, or a comparable product by another manufacturer.
- B. Substitution Limitations:
1. The proposed substitution may or may not be accepted after Architect's and Owner's review for content and schedule impact.
 2. The proposed substitution may or may not be accepted, based on Architect's and Owner's review and approval, for submittal to DSA.
 - a. Architect's and Owner's approval is required prior to DSA submittal.
 - b. DSA approval is required prior to fabrication and installation.
 3. The proposed substitution shall include all costs for redesign with consequential changes by other trades along with the Architect and related approvals by governing agencies.
 - a. Revisions to shop drawings illustrating the proposed changes are not considered adequate for DSA review and approval.

- b. A fee of not less than \$10,000.00 for Architects time to review the proposed substitution prior to submitting for DSA approval shall be included.
 - c. A fee of not less than \$10,000.00 for DSA review processing by the Architect shall be included.
 - d. Fee amounts are minimums. Fees are subject to increase pending Architect and Agency reviews of the proposed substitution.
4. If proposed substitution is not reviewed and approved by DSA in a timely manner, then manufacturer and Installer shall be subject to time and material back charge for delays in the project.

2.8 INTERIOR STOREFRONT SYSTEMS

- A. DSA Reviewed and Approved Basis-of-Design Product: Subject to compliance with requirements, provide Arcadia, Inc.; AR600 Series, 2 inch by 6 inch, Non-Thermal, Center Glazed System, for 1/4 inch Glass, or a comparable product by another manufacturer.
- B. Substitution Limitations:
1. The proposed substitution may or may not be accepted after Architect's and Owner's review for content and schedule impact.
 2. The proposed substitution may or may not be accepted, based on Architect's and Owner's review and approval, for submittal to DSA.
 - a. Architect's and Owner's approval is required prior to DSA submittal.
 - b. DSA approval is required prior to fabrication and installation.
 3. The proposed substitution shall include all costs for redesign with consequential changes by other trades along with the Architect and related approvals by governing agencies.
 - a. Revisions to shop drawings illustrating the proposed changes are not considered adequate for DSA review and approval.
 - b. A fee of not less than \$10,000.00 for Architects time to review the proposed substitution prior to submitting for DSA approval shall be included.
 - c. A fee of not less than \$10,000.00 for DSA review processing by the Architect shall be included.
 - d. Fee amounts are minimums. Fees are subject to increase pending Architect and Agency reviews of the proposed substitution.
 4. If proposed substitution is not reviewed and approved by DSA in a timely manner, then manufacturer and Installer shall be subject to time and material back charge for delays in the project.
- C. 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: Nonthermal.
 2. Glazing System: Retained mechanically with gaskets on four sides.
 3. Glazing Plane: Center.
 4. Finish: High-performance organic finish.
 5. Fabrication Method: Field-fabricated stick system.
 6. Steel Reinforcement: As required by manufacturer.
- D. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

- E. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.9 ENTRANCE DOOR SYSTEMS

- A. DSA Reviewed and Approved 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 another manufacturer.

- B. Substitution Limitations:

1. The proposed substitution may or may not be accepted after Architect's and Owner's review for content and schedule impact.
2. The proposed substitution may or may not be accepted, based on Architect's and Owner's review and approval, for submittal to DSA.
 - a. Architect's and Owner's approval is required prior to DSA submittal.
 - b. DSA approval is required prior to fabrication and installation.
3. The proposed substitution shall include all costs for redesign with consequential changes by other trades along with the Architect and related approvals by governing agencies.
 - a. Revisions to shop drawings illustrating the proposed changes are not considered adequate for DSA review and approval.
 - b. A fee of not less than \$10,000.00 for Architects time to review the proposed substitution prior to submitting for DSA approval shall be included.
 - c. A fee of not less than \$10,000.00 for DSA review processing by the Architect shall be included.
 - d. Fee amounts are minimums. Fees are subject to increase pending Architect and Agency reviews of the proposed substitution.
4. If proposed substitution is not reviewed and approved by DSA in a timely manner, then manufacturer and Installer shall be subject to time and material back charge for delays in the project.

- C. 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.

2.10 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."

2.11 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.

2.12 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.

2.13 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.

2.14 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.

2.15 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 084413 - GLAZED ALUMINUM CURTAIN WALLS

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 glazed aluminum curtain walls.
- B. Related Requirements:
 - 1. Section 084113 "Aluminum-Framed Entrances and Storefronts" for entrances.

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 glazed aluminum curtain walls. 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 vertical-to-horizontal intersection of glazed aluminum curtain walls, 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. Delegated-Design Submittal: For glazed aluminum curtain walls 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: For Installer.
- B. Energy Performance Certificates: For glazed aluminum curtain walls, accessories, and components from manufacturer.
 - 1. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall.
- C. Product Test Reports: For glazed aluminum curtain walls, for tests performed by a qualified testing agency.
- D. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For glazed aluminum curtain walls 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.
- B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025.
- 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 shown on Drawings.
 - 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 agree to repair or replace components of glazed aluminum curtain wall 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 D 2244.
- b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
- 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 curtain wall system, including framing, entrances, 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-404.2.9, 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-404.2.9, 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 glazed aluminum curtain walls.
- B. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 1. Glazed aluminum curtain walls shall withstand movements of supporting structure including, but not limited to, story drift, 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 less than 11 feet 8-1/4 inches (3.6 m).
- E. Structural: Test according to ASTM E 330 as follows:
 1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including 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 E 283 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).
- G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
 1. No evidence of water penetration through fixed glazing and framing areas 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: Glazed aluminum curtain walls 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 shall have U-factor of not more than that indicated on Drawings as determined according to NFRC 100.
 - 2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of not more than that indicated on Drawings as determined according to NFRC 200.
 - 3. Condensation Resistance: Fixed glazing and framing areas 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 CURTAIN WALL SYSTEMS - TYPE 1
- A. DSA Reviewed and Approved Basis-of-Design Product: Subject to compliance with requirements, provide Arcadia, Inc.; Curtain Wall - T500, T500-OPG1500, 2-1/4 inch by 5-1/2 inch, Thermally Broken, Offset Glazed System, for 1/4 inch to 1-1/8 inch Glass, where indicated on Drawings, or comparable product by another manufacturer.
- B. Substitution Limitations:
1. The proposed substitution may or may not be accepted after Architect's and Owner's review for content and schedule impact.
 2. The proposed substitution may or may not be accepted, based on Architect's and Owner's review and approval, for submittal to DSA.
 - a. Architect's and Owner's approval is required prior to DSA submittal.
 - b. DSA approval is required prior to fabrication and installation.
 3. The proposed substitution shall include all costs for redesign with consequential changes by other trades along with the Architect and related approvals by governing agencies.
 - a. Revisions to shop drawings illustrating the proposed changes are not considered adequate for DSA review and approval.
 - b. A fee of not less than \$10,000.00 for Architects time to review the proposed substitution prior to submitting for DSA approval shall be included.

- c. A fee of not less than \$10,000.00 for DSA review processing by the Architect shall be included.
 - d. Fee amounts are minimums. Fees are subject to increase pending Architect and Agency reviews of the proposed substitution.
4. If proposed substitution is not reviewed and approved by DSA in a timely manner, then manufacturer and Installer shall be subject to time and material back charge for delays in the project.
- C. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
1. 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.
- D. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.
1. Include snap-on aluminum trim that conceals fasteners.
- E. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.6 CURTAIN WALL SYSTEMS - TYPE 2

- A. DSA Reviewed and Approved Basis-of-Design Product: Subject to compliance with requirements, provide Arcadia, Inc.; Curtain Wall - T500, T500-OPG1900, 2-1/4 inch by 7 inch, Thermally Broken, Offset Glazed System, for 1/4 inch to 1-1/8 inch Glass, where indicated on Drawings, or comparable product by another manufacturer.
- B. Substitution Limitations:
1. The proposed substitution may or may not be accepted after Architect's and Owner's review for content and schedule impact.
 2. The proposed substitution may or may not be accepted, based on Architect's and Owner's review and approval, for submittal to DSA.
 - a. Architect's and Owner's approval is required prior to DSA submittal.
 - b. DSA approval is required prior to fabrication and installation.
 3. The proposed substitution shall include all costs for redesign with consequential changes by other trades along with the Architect and related approvals by governing agencies.
 - a. Revisions to shop drawings illustrating the proposed changes are not considered adequate for DSA review and approval.
 - b. A fee of not less than \$10,000.00 for Architects time to review the proposed substitution prior to submitting for DSA approval shall be included.
 - c. A fee of not less than \$10,000.00 for DSA review processing by the Architect shall be included.
 - d. Fee amounts are minimums. Fees are subject to increase pending Architect and Agency reviews of the proposed substitution.

4. If proposed substitution is not reviewed and approved by DSA in a timely manner, then manufacturer and Installer shall be subject to time and material back charge for delays in the project.
- C. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 1. 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.
- D. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.
 1. Include snap-on aluminum trim that conceals fasteners.
- E. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.7 VERTICAL SUNSHADES

- A. DSA Reviewed and Approved Basis-of-Design Product: Subject to compliance with requirements, provide Arcadia, Inc.; Brise Soleil Design Series, Custom Sun Shade Shapes, BSD009, or a comparable product by another manufacturer.
- B. Substitution Limitations:
 1. The proposed substitution may or may not be accepted after Architect's and Owner's review for content and schedule impact.
 2. The proposed substitution may or may not be accepted, based on Architect's and Owner's review and approval, for submittal to DSA.
 - a. Architect's and Owner's approval is required prior to DSA submittal.
 - b. DSA approval is required prior to fabrication and installation.
 3. The proposed substitution shall include all costs for redesign with consequential changes by other trades along with the Architect and related approvals by governing agencies.
 - a. Revisions to shop drawings illustrating the proposed changes are not considered adequate for DSA review and approval.
 - b. A fee of not less than \$10,000.00 for Architects time to review the proposed substitution prior to submitting for DSA approval shall be included.
 - c. A fee of not less than \$10,000.00 for DSA review processing by the Architect shall be included.
 - d. Fee amounts are minimums. Fees are subject to increase pending Architect and Agency reviews of the proposed substitution.
 4. If proposed substitution is not reviewed and approved by DSA in a timely manner, then manufacturer and Installer shall be subject to time and material back charge for delays in the project.

2.8 HORIZONTAL SUNSHADES

- A. DSA Reviewed and Approved Basis-of-Design Product: Subject to compliance with requirements, provide Arcadia, Inc.; Brise Soleil Design Series, Custom Sun Shade Shapes, BSD001, or a comparable product by another manufacturer.
- B. Substitution Limitations:
 - 1. The proposed substitution may or may not be accepted after Architect's and Owner's review for content and schedule impact.
 - 2. The proposed substitution may or may not be accepted, based on Architect's and Owner's review and approval, for submittal to DSA.
 - a. Architect's and Owner's approval is required prior to DSA submittal.
 - b. DSA approval is required prior to fabrication and installation.
 - 3. The proposed substitution shall include all costs for redesign with consequential changes by other trades along with the Architect and related approvals by governing agencies.
 - a. Revisions to shop drawings illustrating the proposed changes are not considered adequate for DSA review and approval.
 - b. A fee of not less than \$10,000.00 for Architects time to review the proposed substitution prior to submitting for DSA approval shall be included.
 - c. A fee of not less than \$10,000.00 for DSA review processing by the Architect shall be included.
 - d. Fee amounts are minimums. Fees are subject to increase pending Architect and Agency reviews of the proposed substitution.
 - 4. If proposed substitution is not reviewed and approved by DSA in a timely manner, then manufacturer and Installer shall be subject to time and material back charge for delays in the project.

2.9 ENTRANCES

- A. Entrances: Comply with Section 084113 "Aluminum-Framed Entrances and Storefronts."

2.10 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.

2.11 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
 - 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).

3. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
4. Structural Profiles: ASTM B 308/B 308M.

B. Steel Reinforcement:

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.
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.

2.12 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 A 123/A 123M or ASTM A 153/A 153M requirements.
- C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30 mil (0.762 mm) thickness per coat.

2.13 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. Fabricate components to resist water penetration using one of the following systems:
1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
 2. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.
- E. Curtain-Wall Framing: Fabricate components for assembly using manufacturer's standard assembly method.
- F. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.14 ALUMINUM FINISHES

- A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF or FEVE resin by weight in color coat. 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 primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
 2. Where aluminum is in contact 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 to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
- E. Install components plumb and true in alignment with established lines and grades.
- F. Install glazing as specified in Section 088000 "Glazing."
- G. Install entrance doors as specified in Section 084113 "Aluminum-Framed Entrances and Storefronts."

3.3 ERECTION TOLERANCES

- A. Erection Tolerances: Install glazed aluminum curtain walls 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.
- B. 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.
- C. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

COMPTON COLLEGE
INSTRUCTIONAL BUILDING #2
COMPTON COMMUNITY COLLEGE DISTRICT

tBP PROJECT NO: 20998.00
ADDENDUM 03
SEPTEMBER 24, 2019

END OF SECTION 084413

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 Screenshot: 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: Two component 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, 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. Acrylic-Based Finish Coatings: Factory-mixed acrylic-emulsion coating systems formulated with colorfast mineral pigments and fine aggregates; for use over cement plaster base coats. Include manufacturer's recommended primers and sealing topcoats for acrylic-based finishes.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Parex, a brand of Parex USA, Inc.; Image Smooth Acrylic Finish, or comparable product by one of the following:
 - a. California Stucco Products Corp.
 - b. Dryvit Systems, Inc.

- c. El Rey Stucco Solutions; a Parex USA, Inc. brand.
- d. Finestone; BASF Corp.
- e. Master Wall Inc.
- f. Omega Products International, Inc.
- g. Senergy; BASF Corp.
- h. Shamrock Stucco LLC.
- i. SonoWall, BASF Corp.
- j. Sto Corp.
- k. Stuc-O-Flex International, Inc.

- 2. Color: Match Architect's sample as closely as possible using no organic pigments.

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.

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 102219 - DEMOUNTABLE PARTITIONS

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. Demountable Partitions: Non-progressive, movable and reconfigurable system of unitized or pre-assembled panels.
 - 2. Trim, sealants, hardware, and accessories.
- B. Products Supplied but Not Installed Under This Section:
 - 1. Voice/data cabling, devices, faceplates for thermostats and other devices.
- C. Related Requirements:
 - 1. Section 081416 "Flush Wood Doors."
 - 2. Section 087100 "Door Hardware."
 - 3. Section 088000 "Glazing."
 - 4. Section 095113 "Acoustical Panel Ceilings."
 - 5. Division 26 "Electrical."
 - 6. Division 27 "Communications."

1.03 COORDINATION

- A. Coordinate layout and installation of demountable partition components with other units of Work. Installation of ceilings, floor coverings, lighting fixtures, HVAC equipment, and fire-suppression systems should be completed before demountable partitions are installed.

1.04 DEFINITIONS

- A. STC: Sound Transmission Class.

1.05 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.06 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.
 - 2. Include physical characteristics, durability, resistance to fading, and flame spread characteristics for each type of partition and accessory.
- B. Shop Drawings: For demountable partitions.
 - 1. Include plans, elevations, sections, details, and attachment details.
 - 2. Show location and extent of demountable partitions.
 - 3. Show locations of cutouts for demountable partitions mounted accessories.
- C. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:
 - 1. Panel Finish Face: Manufacturer's standard-size unit, but not less than 12 inches (300 mm) square.
 - 2. Base Trim: Manufacturer's standard-size unit, but not less than 12 inches (300 mm) long.
 - 3. Door Finish Face: Comply with requirements in Section 081416 "Flush Wood Doors."
 - 4. Glazing: Comply with requirements in Section 088000 "Glazing."

1.07 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of demountable partition.

1.08 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For demountable partitions to include in maintenance manuals.
 - 1. Recommended cleaning materials and warnings about cleaning methods that could be detrimental to finishes and performance.
 - 2. Installation manual detailing methods to move reuse and adjust demountable product.

1.09 MAINTENANCE MATERIAL SUBMITTALS

- A. Deliver to the Owner, not less than three percent of the Project total for each component, panel and accessory of each type, color, and finish of demountable partition system exclusive of material required to properly complete installation. Furnish accessory components and installation tools as indicated on schedule. Furnish extra materials from same production run as materials installed. Package extra materials with protective covering, identified with appropriate labels.
- B. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, removal, and relocation of demountable partition system.

1.10 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has successfully completed demountable partition installations similar in material, design, and extent to that indicated for this Project and is mutually accepted by the manufacturer and the customer.
- B. Certification: Include supporting certified laboratory testing data indicating that material meets specified test requirements.
- 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.
 - 2. Design Requirements:
 - a. Demountable partition system shall offer maximum flexibility and reusability to accommodate frequent and quick relocation work without loss of materials, damage or modification to panels or to adjoining structures such as ceilings, fixed walls and floors.
 - b. Demountable partition system shall be factory assembled, unitized or pre-assembled, non-progressive, and modular, allowing the removal of individual panels from any location without disturbing adjoining units and providing interchangeability of panels and door units on the same module.
 - 1) Stick built systems are not acceptable.
 - c. Demountable partition system shall include flush connectors, finished to match the panel, to provide a monolithic aesthetic.
 - d. Demountable partition system shall include flush head detail.
 - e. Demountable partition system shall include base assembly with an integrated leveling system permanently attached to the panel.
 - 1) Detached and loosely shipped floor tracks and leveling components are not acceptable.
 - f. Demountable partition system shall include solid panels available in a choice of finishes and substrates that include, but are not limited to, marker board steel, wood veneer, powder coated steel, vinyl-covered steel, fabric-covered steel, and fabric-covered tack board.
 - 1) Gypsum and melamine are not acceptable.
 - g. Panels shall be stackable (top or bottom) to accommodate ceiling height changes and panel type changes (i.e., solid/glass or glass/solid configurations).
 - h. Panel shells and faces shall be removable and interchangeable in the field without dismantling complete units.
 - i. Demountable partition system shall be very flexible to accommodate the building conditions.
 - 1) Demountable partition system shall include flexible vertical adjustability.
 - 2) Adjustable, u-channel head assembly shall provide a plus or minus 1/2 inch (13 mm) adjustment at the ceiling.

- 3) Self-contained leveling glide system and a flush 4 or 5 inch (102 or 127 mm) high base cover shall allow for an adjustment of plus or minus 1 inch (25 mm) for a 4 inch (102 mm) high base and plus or minus 1-1/2 inch (38 mm) for a 5 inch (127 mm) high base at the floor.
 - 4) Demountable partition system shall have an overall vertical adjustment of plus or minus 1-1/2 inch (38 mm) for 4 inch (102 mm) high base and plus or minus 2 inches (51 mm) for 5 inch (127 mm) high base to compensate for ceiling and floor irregularities.
 - 5) Telescopic, spring-loaded wall post or u-channel shall allow for a plus or minus 1 inch (25 mm) horizontal adjustment where demountable partition system meets walls, columns, and window mullions.
 - 6) All components shall be able to accommodate incremental sizes in 1/16 inch (1.59 mm) increments.
- j. Demountable partition system shall include modular power system that can terminate within solid panels and base areas of both glass and solid panels (overlapping 5 inch (127 mm) high base only).
- 1) Modular power connections within solid panels and base areas shall be accessible and inspectable before, during and after installation.
 - 2) Demountable partition system shall include open access to power and data cabling connections and pathways to accommodate wall disassembly and relocation.
 - 3) Solid panels shall be able to be field retrofitted to accept additional modular power outlets, conventional hardwired electrical outlets, fire and life safety strobes and devices, thermostats, and security hardware and devices without complete wall section removal.

1.11 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.
 - a. Include not less than one of each type of panel, door, and accessory required.
 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.

1.12 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project Site in original factory wrappings and containers/skids, clearly labeled with identification of manufacturer, brand name, model number and order number. Store materials in original undamaged packages and containers, inside well ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity; store product according to installation manual and away from other trades.
- B. Comply with instructions and recommendations of manufacturer for special delivery, storage, and handling requirements.

1.13 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install demountable partition components 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 demountable partitions 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 demountable partition components by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where demountable partitions are indicated to fit to other construction, establish dimensions for areas where demountable partitions are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.14 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of demountable partition systems 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

2.01 MANUFACTURERS

- A. Source Limitations: Obtain demountable partition system and accessories from single source from single manufacturer.

1.1 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-404.2.9, 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-404.2.9, 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.
 - 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.

2.02 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide demountable partitions capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
1. Load-Bearing Capacity of Panel System: Not less than 7 lbs/linear inch (3.175 kg/25.4 mm) distributed proof load when tested according to BIFMA X 5.6, Section 03, Table 06.
 2. Transverse-Load Capacity of Panel System:

- a. Interior wall panel deflections shall not exceed 1/120 of the span for flexible facing material or 1/240 of the span for brittle facing materials under a 5 psf (0.240 kN/sq m) uniform transverse design load per the 2016 CBC Table 1604.3. Interior wall panel deflections for glass panel frames shall not exceed 1/175 of the span or 0.75 inches (19 mm), whichever is less under a 5 psf (0.240 kN/sq m) uniform transverse design load per the 2016 CBC Table 1604.3.
 - b. 2016 CBC Section 1607.14: Interior demountable partition or butt-glazed entrances/storefronts wall products that exceed 6 feet (1829 mm) in height, including their finish materials, shall have adequate strength to resist the loads which they are subjected but not less than a horizontal load of 5 psf (0.240 kN/sq m).
 - c. Seismic Performance: Provide demountable partitions capable of withstanding the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Sound Control: Solid panels shall provide an overall sound transmission class of not less than 44 STC rating in accordance with ASTM E90, ASTM E412 when recessed ceiling channel, recessed panel connectors and wallposts are used. Solid panels shall provide an overall sound transmission class of not less than 48 STC rating in accordance with ASTM E90, ASTM E412 when flush ceiling channel, flush panel connectors and U-channels are used.
- C. Fire Retardancy: No flammable materials shall be used in the manufacture of the wall system. Provide independent laboratory tests for surface-burning characteristics of panel finishes in accordance with ASTM E84.
1. Flame Spread: Class A for powder coat finish and steel.
- D. Electrical Components, Devices and Accessories: UL listed and labeled as defined in CEC and NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Combustibility Performance: Product shall have finishes and construction acceptable for use in non-combustible buildings, in accordance with Chapters 6 and 8 of the 2016 CBC.

2.03 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".

2.04 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. 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).
- F. 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.
- 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. 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.
- I. Low-Emitting Materials: Sealants and sealant primers shall comply with the requirements of authorities having jurisdiction.
- J. Low-Emitting Materials: Paints and coatings shall comply with the requirements of authorities having jurisdiction.
- 2.05 NON-OBSOLENCE
- A. Demountable partition system components and parts, with exception of third party supplied product (such as door hardware, glass, film applied to glass) are guaranteed to be compatible and available for purchase for not less than 10 years from the date of the original order.

2.06 DEMOUNTABLE PARTITION SYSTEM

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Krueger International, Inc. (KI); Genius Architectural Wall, or a comparable product by another manufacturer.
- B. Solid Panels with Steel Substrate: 3-1/2 inches (88.9 mm) thick and consisting of an aluminum extruded frame construction, two removable panel shell assemblies each composed of one sheet of 0.0299 inch (0.76 mm) thick (22 gage nominal) steel glued to vertical / horizontal stiffeners and intermediate horizontal stiffeners, non-toxic fiberglass insulation, and the base assembly. Top of panel engages the ceiling channel. Aluminum frames (including glass panels) as a standard will have cavities on each side to accommodate cabling. Field notching the horizontal frame members will also allow easy cable access from the ceiling or the floor. As standard, solid panel vertical frame posts can be slotted for hang-on furniture and the slots concealed by a dual durometer PVC gasket which is 1 inch (25 mm) wide and recessed from panel face or by a flush-to-panel face connector. Component bracketry is optional. Panels to contain integral, adjustable bottom connectors, and the panel shells to be equipped with a mushroom-shaped extrusion that forms a compression fit with the vertical frame for easy removal from the frame structure.
1. Type: Factory finished.
 2. Panel Thickness: Manufacturer's standard, 3-1/2 inches (88.9 mm) thick.
 3. Panel Width: As indicated on Drawings.
 4. Panel Finish: As indicated on Drawings.
 5. Panel Color and Pattern: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.
 6. Magnetic Accessory
- C. Solid Panels with Project Specific Substrate: 3-1/2 inches (88.9 mm) thick and consisting of an aluminum extruded frame construction, two removable panel shell assemblies each composed of Plastic Laminate face laminated to MDF, nontoxic fiberglass insulation, and the base assembly. Top of panel engages the ceiling channel. Aluminum frames (including glass panels) as a standard will have cavities on each side to accommodate cabling. Field notching the horizontal frame members will also allow easy cable access from the ceiling or the floor. As standard, solid panel vertical frame posts can be slotted for hang-on furniture and the slots concealed by a dual durometer PVC gasket which is 1 inch (25 mm) wide and recessed from panel face or by a flush-to-panel face connector. Component bracketry is optional. Panels to contain integral, adjustable bottom connectors, and the panel shells to be equipped with a mushroom-shaped extrusion that forms a compression fit with the vertical frame for easy removal from the frame structure.
1. Type: Factory finished.
 2. Panel Thickness: Manufacturer's standard, 3-1/2 inches (88.9 mm) thick.
 3. Panel Width: As indicated on drawings.
 4. Panel Color and Pattern: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.
- D. Aluminum Glass Framing:
1. Frame Finishes: Factory-applied powdercoat paint.
 2. Frame Color: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.
 3. Glass Frame Vertical Dimension: As indicated on drawings.
 4. Glass Panel Configuration: Single center mounted.
- E. Panel Connector or Joint Closure:

1. Connector Type: Flush.
 2. Finish: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.
- F. Trim: Base trim is continuous, factory-finished, snap-on type or recessed; adjustable for variations in floor. Ceiling trim is continuous and compensates for ceiling irregularities.
1. Base Trim Profile: Flush.
 2. Flush Base Trim Height: 4 inches (102 mm).
 3. Ceiling Trim Profile: Flush.
 4. Exposed-Metal Trim Finish: Factory-applied powdercoat paint.
 5. Trim Color: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.
- G. Wood Door Leaves: Comply with requirements in Section 081416 "Flush Wood Doors."
- H. Aluminum Door Leaves: Manufacturer's standard aluminum extrusion and fully glazed.
1. Door Finish: Factory-applied powdercoat paint.
- I. Door Frames: Manufacturer's standard aluminum extrusion, factory- machined to receive hardware, for 1-3/4 inch (45 mm) thick doors.
1. Frame Finishes: Factory-applied powdercoat paint.
 2. Frame Color: As indicated on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.
 3. Frame Height: As indicated on Drawings.
 4. Transom Height Finish (if applicable): As indicated on Drawings.
 5. Frame Type: As indicated on Drawings.
- J. Door Hardware: Comply with requirements in Section 087100 "Door Hardware."
- K. Glass and Glazing: Comply with requirements in Section 088000 "Glazing."
- L. Electrical: Comply with requirements in Division 26 "Electrical" sections. All electrical components shall be UL listed and approved.
- M. Communications: Comply with requirements in Division 27 "Communications" sections. All electrical components shall be UL listed and approved.
- N. Solid Panel Acoustical Rating: Not less than STC 44.
- O. Seals: Manufacturer's standard.
- 2.07 FABRICATION
- A. Demountable Panels: Factory-assembled, flush, hollow unit construction; with faces smooth and free of buckles, oil canning, and seams.
1. Insulated with solidly packed, formaldehyde free insulation.

2. Fabricate panels for installation with concealed fastening devices and pressure-fit components that will not damage ceiling or floor coverings.
 3. Fabricate panels with continuous light-and-sound seals at floor, ceiling, and other locations where panels abut fixed construction.
 4. Factory glaze panels to the greatest extent possible.
- B. Components: Fabricate components for installation with concealed fastening devices and pressure-fit members that will not damage ceiling or floor coverings.
1. Fabricate for installation with continuous seals at floor, ceiling, and other locations where partition assemblies abut fixed construction and for installation of sound attenuation insulation in partition cavities.

2.08 FINISHES, GENERAL

- A. Protect mechanical 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 the 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.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that conditions are acceptable for installation.
- B. Verify walls interfacing with the demountable partition system are true and plumb.
- C. For demountable partition system manufacturer to accept responsibility of dimensional compatibility between demountable partition system and adjacent construction, demountable partition system manufacturer shall have access to the completed adjacent construction for accurate field measuring not less than eight weeks prior to requiring product on site to commence installation.
1. If time line does not permit the eight weeks lead time, demountable partition system manufacturer shall provide "hold-to" dimensions for the Contractor.
 2. Contractor shall assume responsibility that adjacent construction complies with "hold-to" dimensions.
- D. Do not proceed until unsatisfactory conditions have been corrected in a manner acceptable to Installer.
1. Commencement of installation shall be construed as acceptance of conditions.

3.02 PREPARATION

- A. Prior to installation of demountable partition system, clean floor to remove dust, debris, and loose particles.

- B. Illuminate areas of installation to provide an ambient light level of not less than 100 fc (1076 lx) measured in the area where partitions are to be installed.
- C. Maintain temperature in the area of installation at not less than 65 deg F (18 deg C) with relative humidity not more than 70 percent for not less than 48 hours prior to installation, during installation, and 48 hours after installation.

3.03 INSTALLATION

- A. General: Comply with demountable partition system manufacturer's written installation instructions, Drawings, and approved Shop Drawings.
- B. Install demountable partitions and accessories after other finishing operations, including painting, have been completed in area of partition installation.
- C. Install demountable partition systems rigid, level, plumb, and aligned.
 - 1. Install seals to prevent light and sound transmission at connections to floors, ceilings, fixed walls, and abutting surfaces.
- D. Installation Tolerance: Install each demountable partition so surfaces vary not more than 1/8 inch (3 mm) from the plane formed by the faces of adjacent partitions.
- E. Do not alter ceiling suspension system.
- F. Install door and frame, solid panel and frame, and glazing and frame assemblies securely anchored to partitions and with doors aligned and fitted.
 - 1. Install and adjust door hardware for proper operation.

3.04 DEMONSTRATION

- A. Engage a factory-authorized service representative to demonstrate and train Owner's maintenance personnel to adjust, operate, and maintain demountable partitions.

END OF SECTION 102219

SECTION 105113.20 - METAL CELL PHONE CHARGING LOCKERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Metal cell phone charging lockers.

B. Related Requirements:

1. Section 092216 "Non-Structural Metal Framing" for metal backing for anchoring metal cell phone charging lockers.

1.02 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 metal cell phone charging locker.

B. Shop Drawings: For metal cell phone charging lockers.

1. Include plans, elevations, sections, and attachment details.

C. Samples: For each color required.

1. Provide full-size Sample of custom graphics.

D. Product Schedule: For metal cell phone charging lockers. Use same designations indicated on Drawings.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For special warranty.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For adjusting, repairing, and replacing locker doors, locks, latching mechanisms, and charging equipment to include in maintenance manuals.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer approved by the manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver metal cell phone charging lockers until spaces to receive them are clean, dry, and ready for their installation.
- B. Protect materials from damage during delivery, storage, handling, and installation.

1.07 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.08 COORDINATION

- A. Coordinate sizes and locations of recessed openings for metal cell phone charging lockers.
- B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal cell phone charging lockers can be supported and installed as indicated.

1.09 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of metal cell phone charging lockers that fail in materials or workmanship, excluding finish, within specified warranty period.
 - 1. Damage from deliberate destruction and vandalism is excluded.
 - 2. Warranty Period for Metal Cell Phone Charging Lockers: Lifetime from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations: Obtain metal cell phone charging lockers and accessories from single source from single manufacturer.

2.02 ACCESSIBILITY REQUIREMENTS

- A. Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design.
- B. Storage:
 - 1. General: Storage facilities shall comply with CBC Section 11B-225 per CBC Section 11B-225.1.

2. Storage: Where storage is provided in accessible spaces, at least one of each type shall comply with CBC Section 11B-811 per CBC Section 11B-225.2.
 - a. Lockers: Where lockers are provided, at least 5 percent, but no fewer than one of each type, shall comply with CBC Section 11B-811 per CBC Section 11B-225.2.1.
 - C. 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.
 - D. Reach Ranges:
 1. General: Reach ranges shall comply with CBC Section 11B-308 per CBC Section 11B-308.1.
 - E. 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.
 - F. Storage:
 1. General: Storage shall comply with CBC Section 11B-811 per CBC Section 11B-811.1.
 2. Clear Floor or Ground Space: A clear floor or ground space complying with CBC Section 11B-305 shall be provided per CBC Section 11B-811.2.
 3. Height: Storage elements shall comply with at least one of the reach ranges specified in CBC Section 11B-308 per CBC Section 11B-811.3.
 4. Operable Parts: Operable parts shall comply with CBC Section 11B-309 per CBC Section 11B-811.4.
- 2.03 METAL CELL PHONE CHARGING LOCKERS
- A. Basis-of-Design Product: Subject to compliance with requirements, provide KwikBoost; Phone Charging Locker, Wall Mounted, 8 Bay, or a comparable product by another manufacturer.
 - B. Locker Dimensions: 24 inches (610 mm) wide by 5 inches (127 mm) deep by 47-1/2 inches (1207 mm) high.
 - C. Doors: 8.
 - D. Hinges: Manufacturer's standard continuous hinges, full height.
 - E. Projecting Door Handle and Latch: Manufacturer's standard.
 - F. Locks: Digital keypad locks with user generated codes.
 - G. Finish: Manufacturer's standard.
 - H. Custom Graphics: Owner will provide layout.

I. Accessories:

1. Three cables per charging bay.
 - a. Provide Apple Lightning, Micro USB, and USB Type-C in each bay.
2. Extra security locker key.
 - a. To be used by administrator in addition to electronic keypad locks that allow user to set their own code (four digits).

2.04 FABRICATION

A. Accessible Metal Cell Phone Charging Lockers:

1. Locate bottom of lowest locker door not less than 15 inches (381 mm) above finish floor or ground.
2. Locate top of lowest locker door not more than 48 inches (1219 mm) above finish floor or ground.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install metal cell phone charging lockers level, plumb, and true; shim as required, using concealed shims.
1. Anchor metal cell phone charging lockers as recommended by manufacturer using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
- B. Comply with applicable provisions in the CBC and the 2010 ADA Standards for Accessible Design for accessible metal cell phone charging locker mounting height.
1. Locate bottom of lowest locker door not less than 15 inches (381 mm) above finish floor or ground.
 2. Locate top of lowest locker door not more than 48 inches (1219 mm) above finish floor or ground.
 3. Metal cell phone charging lockers shall not project more than 4 inches (101.6 mm) into the path of travel.
- C. Metal Cell Phone Charging Lockers Mounting Heights: Install metal cell phone charging lockers at mounting heights indicated on Drawings.

3.02 ADJUSTING

- A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that locking devices operate properly.

3.03 CLEANING

- A. Clean interior and exposed exterior surfaces, removing debris, dust, dirt, and foreign substances on exposed surfaces.

3.04 PROTECTION

- A. Protect metal cell phone charging lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.
- B. Touch up marred finishes, or replace metal cell phone charging lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 105113.20

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SECTION 107113.43 - FIXED SUN SCREENS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fixed custom sunshades as shown on the drawings, as specified and as needed for a complete and proper installation.
 - a. The drawings show the extent of the work, the dimensioned profile and depth of the sunshade to be provided.

B. Related Requirements:

1. Section 051200 "Structural Steel."
2. Section 055000 "Metal Fabrications."

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 for Verification:

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.

1.03 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.

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 source from single manufacturer.

2.02 SUNSHADES - TYPE SS-1

- A. CS 200-4 Horizontal Sunshades.
 - 1. Blades: 4 inches (102 mm) wide by 12 inches (305 mm) high, rectangular tube 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

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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.

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 minimum 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 temperature 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 10 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 maximum 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. In 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 minimum, 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 minimum 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 10/100MHz) 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 through 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 minimum, 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. 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 minimum, 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 10K thermistors, 0-5VDC, 4-20mA, dry contact signals and a minimum 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 IOK 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 1 painted 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-W111 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 mounting.
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 (2-10VDC, 4-20mA).
4. Booster-heat valve actuation shall be floating type or analog (2-10Vdc, 4-20ma).
5. Primary valve control shall be analog (2-10VDC, 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 IOVA 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-IOVDC, 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 zero 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 O-rings designed for on-off or modulating service and require no maintenance.
 - l. The valves shall have an ISO type, 4-bolt flange for mounting 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 O-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 (DN150) 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, 1 ϕ H, 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 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-IOVDC, 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 pressure drop is equal to the sum of coil drop plus the balance 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 1 when 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 minimum, 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.

G. HANGER AND SUPPORT INSTALLATION

1. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
2. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
3. Install hangers for steel piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
4. Support horizontal piping within 12 inches of each fitting.
5. Support vertical runs of steel piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

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.
- 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 BA9-1, 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 free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Install piping to allow application of insulation.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- K. 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.
- L. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- M. 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.
- N. Install valves according to Section 230523 "General-Duty Valves for HVAC Piping."
- O. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- P. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- Q. Install shutoff valve immediately upstream of each dielectric fitting.
- R. 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.
- S. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.
- T. 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."

- U. 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."
- V. 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 1-1/4: Maximum 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. 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 265561 – THEATRICAL LIGHTING

PART 1 GENERAL

1.1 SCOPE

- A. The Electrical Contractor, as part of the work of this Section, shall provide, install and test a complete lighting control system as specified herein for areas indicated on the Drawings and circuit schedules.
- B. The Electrical Contractor shall furnish all conduit, wire, connectors, hardware and other incidental items necessary for the complete and proper operation of the lighting control system.
- C. The Electrical Contractor shall coordinate all work described in this Section with all other applicable Plans and Specifications, including but not limited to:
 - 1. General Conditions
 - 2. Electrical Section General Provisions
 - 3. Conduit
 - 4. Wire and Cable

1.2 SUBMITTALS

- A. Manufacturer shall provide four sets of full system submittals. Submittals shall include:
 - 1. Full system riser diagram(s) illustrating interconnection of system components, wiring requirements, back box sizes and any special installation considerations.
 - 2. Full set of printed technical data sheets.
 - 3. Detailed set of dimmer schedules
 - 4. Detailed set of circuit and control schedules, including a complete list of all deviations from Specifications.
- B. Manufacturer shall provide any additional information, including equipment demonstrations, as required by the Engineer or Specifier to verify compliance with Specifications.

1.3 SYSTEM DESCRIPTION

- A. The system shall be designed for the control of Architectural and Theatrical Lighting and shall consist of factory pre-wired dimming and processing rack enclosures containing dimmers, relays, power supplies, breakers, terminals and/or control electronics.
- B. System shall work in conjunction with specified low-voltage control stations.

1.4 QUALITY ASSURANCE

- A. Manufacturer shall be one who has been continuously engaged in the Manufacturer of lighting control equipment for a minimum of 10-years. All dimmer and cabinet fabrication must take place in a U.S. Manufacturing Plant.

- B. The Manufacturer shall have a factory authorized stocking service center with at least one full time service Technician on staff located within 150 miles of the job site. In addition, the Manufacturer shall have a toll free 24-hour hotline with a maximum response time of 20 minutes, 24 hours a day and 365 days a year.
- C. All equipment, where applicable Standards have been established, shall be built to the Standards of Underwriters Laboratories, Inc., the National Electric Code and the United States Institute for Theater Technology. Permanently installed power distribution equipment such as dimmer racks and distribution shall be UL and C-UL Listed, and/or CE marked (where applicable) and bears the appropriate labels. Portable equipment such as consoles and fixtures shall be UL and C-UL Listed, ETL Listed and/or CE marked (where applicable) and bear the appropriate labels.

1.5 ACCEPTABLE MANUFACTURERS

- A. The equipment herein specified shall be manufactured by

Electronic Theatre Controls
PO Box 620979
Middleton, WI 53562
Phone: 608/831-4116
Fax: 608/836-1736
- B. Alternative Manufacturers must submit a full pre-approval package prior to bid date. Package shall consist of items listed in Part 1, Section 1.03A.
- C. Permission to bid does not imply acceptance of the Manufacturer. It is the sole responsibility of the Electrical Contractor to ensure that any price quotations received and submittals made are for controls systems that meet or exceed the Specifications.

PART 2 PRODUCTS

2.1 ARCHITECTURAL CONTROL PROCESSOR MODULES

- A. Control Processor Modules
 - 1. The Architectural Control Processor shall be the Unison Paradigm Series, P-ACP Control Processor as manufactured by Electronic Theatre Controls, Inc., or equal.
 - 2. Mechanical
 - a. The Architectural Control Processor (ACP) assembly shall be designed for use in DRd Series Power Enclosures and ERn Series Control Enclosures.
 - b. The processor shall utilize microprocessor based, solid state technology to provide multi-scene lighting and building control.
 - c. ACP module electronics shall be contained in a plug-in assembly.
 - 1) The module shall be housed in a formed steel body and contain no discrete wire connections.
 - a) No tools shall be required for module removal or insertion.

- d. The ACP shall be convection cooled.
- e. User Interface
 - 1) The ACP shall utilize a backlit liquid crystal display capable of graphics and eight lines of text.
 - 2) The ACP shall provide an alpha-numeric keypad for data entry and navigation
 - 3) The ACP shall provide a touch-sensitive control wheel for navigation.
 - 4) The ACP shall provide shortcut buttons to assist in navigation, selection, and data entry.
 - 5) The ACP keypad, buttons, and wheel shall be backlit for use in low-light conditions.
 - a) The backlight shall have a user selectable time out, including no time out.
- f. The ACP shall provide a front-panel RJ45 receptacle for Ethernet connection to the processor for configuration, live control, and web-browser-based system access.
 - 1) The RJ-45 receptacle shall be secured behind the locking door.
- g. The ACP shall provide a Secure Digital (SD) Removable Media slot on the front panel for transfer of configuration data.
 - 1) The SD slot shall be secured behind the locking door.
- h. The ACP shall provide a Universal Serial Bus (USB) port on the front panel for transfer of configuration data.
 - 1) The USB port shall be secured behind the locking door.
- i. Architectural Lighting System configuration and program information shall be stored in flash memory, which does not require battery backup.
 - 1) The ACP shall provide a Compact Flash (CF) Card as backup flash memory and storage.
 - 2) The CF Card is located in the back of the ACP, and can be accessed only by removing the ACP.
 - 3) The ACP data can be exchanged by inserting the CF card into another ACP.

B. Electrical

- 1. The ACP shall require no discrete wiring connections; all wiring shall be terminated into Dimming or Control Enclosure.
- 2. The ACP shall require low-voltage power supplied by the Dimming or Control enclosure.
- 3. The ACP shall be hot-swap capable.
- 4. The ACP shall support Echelon LonTalk with LinkPower communications with control stations and other remote devices, including button stations, button/ fader stations, Touchscreen stations, sensors, and third party LonMARK compliant products.
 - a. The LinkPower network shall utilize polarity-independent, low-voltage Class II twisted pair wiring, type Belden 8471 (unshielded) or Belden 8719 (shielded) or equivalent. One # 14 AWG drain wire will be required for system not using grounded metal conduit. Touchscreen stations, interface stations and portable stations connectors will also require two #16 AWG wires.
 - b. The LinkPower network shall be topology free. Network wiring may be bus, loop, home run, star or any combination of these.

- c. Link power wiring shall permit a total wire run of 1640 feet (500m) without a repeater. Repeater option modules shall be available to increase wiring maximums in increments of 1640 feet (500m)
 - d. Link power wiring between stations shall not exceed 1313 feet (400m).
5. The ACP shall support 10/100BaseTX, auto MDI/MDIX, 802.3af compliant Ethernet networking using TCP/IP, ESTA BSR E1.17 Advanced Control Networks (ACN) and ESTA BSR E1.31 (sACN) Protocols for internal communication and integration with third-party equipment.
 6. The ACP shall support EIA-RS232 Serial protocol for bi-directional command and communication with third-party equipment.
 7. The ACP shall support two discrete ESTA DMX512A ports, configurable as input or output ports.*
 - a. *When used in a Dimming Enclosure, the second port is always an output port.
 8. The ACP shall provide four onboard dry contact closure inputs for integration with third-party products.
 9. The ACP shall provide four onboard contact closure outputs, rated at 1A at 30VDC, for integration with third-party equipment.

C. Functional

1. Capacity
 - a. Shall support 1024 channels of control.
 - b. Shall support two physical DMX ports, each of which may be configured as an input or output.
2. System
 - a. Runtime application shall utilize support Net3 system interoperability.
 - b. System shall support the use of Network Time Protocol for real time clock synchronization.
 - c. System shall support remote firmware upload an over Ethernet connection from a connected PC running the Light Designer software or another connected processor.
 - d. System shall support local firmware upload from removable media (SD Card, USB Flash Drive).
3. Diagnostics
 - a. Shall output an Event log.
 - b. Standard log shall store a fixed-length history of recent activity.
 - c. Separate critical log shall only store important messages (such as boot-up settings).
4. Configuration Data
 - a. Configuration Data can be uploaded over an Ethernet connection from a PC running Light Designer application.
 - b. Configuration Data can be retrieved from another Paradigm Processor
 - c. A Paradigm Processor shall make its configuration data available for retrieval by another Processor as a backup/recovery mechanism
 - d. Configuration Data shall be stored on solid-state media that can be removed to facilitate transfer between Processor units
 - e. Configuration Data may be loaded to and from removable media access provided on front panel
 - f. Configuration Data for the entire System shall be available for download from any single Processor

- g. Shall store configuration data for Dimming enclosure processors and shall make available for download
5. Scalability
- a. Adding additional Processors to a System shall proportionately increase its overall capabilities up to a maximum Project size
 - b. The maximum number of Processors configured as a project shall be at least twelve. The use of a Central Control Processor (P-CCS) shall allow for larger system sizes up to 72 processors
 - c. Multiple Processors shall utilize the Ethernet network to remain time synchronized and share control information
 - d. Multiple Processors shall utilize the Ethernet network to maintain configuration data synchronization as modifications are made
 - e. Failure of a single Processor shall not prohibit continuing operation of the remaining Processors
 - f. It shall be possible for multiple Systems to coexist on the same physical network with logical isolation between Systems
6. Local User Interface
- a. Shall provide access to Processor setup (IP address)
 - b. Shall provide access to Processor status and diagnostics
 - c. Where the Processor is installed within a Dimming enclosure, shall provide access to Dimming enclosure setup, status and diagnostics
 - d. Shall provide control functionality for Control Channels, Zones, Fixtures, Groups, Presets, Macros, Walls and Sequences within the current configuration.
 - e. Shall provide functionality to schedule astronomical and real time events (add/edit/delete).
 - f. Shall allow for display of local DMX information.
 - g. Shall allow for transfer of log files to local removable media.
 - h. Shall allow to perform firmware upgrades for connected Dimming enclosures.
 - i. Shall allow for transfer of configuration to and from Dimming enclosures using removable media.
 - j. Shall allow for transfer of configuration to and from LCD Stations using removable media.
 - k. Shall allow for binding of Stations.
7. Access Controls
- a. There shall be two user accounts - Administrator and User with separate password protection.
 - b. Account and password settings shall be local to each Processor.
 - c. Access Controls shall be applied to certain areas of the Paradigm Local User Interface and Web Interface.
8. Web User Interface
- a. Shall be an internal web server accessible via Ethernet port.
 - b. Shall support common web browsers on Windows and Mac platforms.
 - c. Shall provide functionality to Activate and Deactivate Presets.
 - d. Shall provide functionality to schedule timed events (add/delete).
 - e. Shall display status information.
 - f. Shall display log files.
 - g. Shall allow for configuration of Processor settings (date, time).
 - h. Shall allow for upload and download of configuration data.
 - i. There shall be links to other web-enabled devices in the System, including other Paradigm Processors.

9. Stations

- a. Stations shall be connected to a Paradigm Processor via a LinkPower network or Ethernet.
- b. Station discovery and binding shall be accomplished from the Local User Interface or Light Designer.

10. Net3 and ACN Devices

- a. Paradigm Processors shall provide DMX-Net3 gateway functionality
- b. Net3 devices shall be connected to and controlled from the Processor via Ethernet
- c. It shall be possible to send and receive Macro triggers defined within the System configuration via Net3
- d. There shall be support for a maximum of 1024 Streaming ACN outputs configured to a maximum of twelve universes per Processor

11. Operation

- a. When contained in a dimming enclosure, a snapshot of the dimming enclosure output data shall be stored in persistent memory so that hardware can access it for immediate output on boot
- b. DMX output refresh rate shall be configurable
- c. There shall be support for 16-bit DMX Attributes
- d. DMX inputs may be patched to DMX and Streaming ACN outputs as external sources
- e. Streaming ACN inputs shall be patched to DMX outputs (gateway) as external sources
- f. Where there are multiple external sources then priority and HTP shall be used to perform arbitration
- g. External and internal sources shall be arbitrated based on user-selection of standard or custom rules
- h. On Preset Record, the values of Attributes within the Preset shall be updated to reflect the current output
- i. The total output may be the combination of many different Presets running concurrently
- j. There shall be no hard limit on number of concurrent cross fades
- k. Multiple Presets controlling the same Attribute shall first interact based on priority and second based on Latest Takes Precedence (LTP) or Highest Takes Precedence (HTP)
- l. LTP and HTP operation shall be supported simultaneously and interact (at the same priority) using HTP
- m. Settings due to LTP Presets may be automatically discarded from operation when overridden
- n. It shall be possible to specify that a Preset or Attribute Control will persist when overridden
- o. A Preset may be designated as an HTP Override and shall cause HTP values to be discarded
- p. It shall be possible to modify the rate of a Preset (Cross fades, Effects) from a Control within the System
- q. Each Preset shall have a status that can be Activated, Deactivated or Altered
- r. Preset status may be set based on matching levels in the current output as an option
- s. On startup the System shall be capable of automatically executing timed events within the previous 24 hours to synchronize its initial output state with the current time of day

12. Serial Input/Output

- a. RS232 shall support 8-bit word length, parity selection and 1 or 2 stop bits
- b. RS232 shall support baud rates from 4800 to 115,200 bps
- c. Serial input and output messages are fully customizable
- d. Serial output messages can be generated by any Control or Event

2.2 STATION POWER MODULES

A. Station processor Modules

1. The Station Power Module shall be the Unison Paradigm P-SPM Series Station Power Module as manufactured by Electronic Theatre Controls, Inc., or equal.
2. Mechanical
 - a. The Station Power Module (SPM) assembly shall be designed for use in DRd Series or ERn Rack Enclosures
 - b. The SPM shall convert input power into low-voltage (Class II) power with data line and a secondary auxiliary low-voltage line to energize button, button/fader, touchscreen, and interface devices for multi-scene lighting and building control.
 - c. SPM module shall be contained in a plug-in assembly.
 - 1) The module shall be housed in a formed steel body and contain no discrete wire connections.
 - a) No tools shall be required for module removal or insertion.
 - d. The SPM shall be convection cooled.
 - e. User Interface
 - 1) The SPM shall utilize light emitting diodes (LED's) to indication function, status and fault.
 - f. The SPM shall be secured behind the locking door.
 - g. Wall-mounted, direct wire and 19-inch rack-mount, connectorized repeater and dual-repeater variants shall be available from the same Manufacturer where required on the Project.
3. Electrical
 - a. The SPM shall require no discrete wiring connections; all wiring shall be terminated into the dimming enclosure, unless required by a variant
 - b. The SPM shall require line-voltage power supplied by the Contractor, terminated inside the dimming or control enclosure.
 - c. The SPM shall be hot-swap capable.
 - d. The SPM, in conjunction with a matching Architectural Control Processor (ACP), shall support Echelon LinkPower communications with remote devices, including button, button/fader, touchscreen and interface stations, and shall interoperate with LonMARK-approved third-party devices.
 - 1) The LinkPower network shall utilize polarity-independent, low-voltage Class II twisted pair wiring, type Belden 8471 (unshielded) or Belden 8719 (shielded) or equivalent. One # 14 AWG drain wire will be required for system not using grounded metal conduit.
 - 2) The LinkPower network shall be topology free. Network wiring may be bus, loop, home run, star or any combination of these.
 - 3) Link power wiring shall permit a total wire run of 1640 feet (500m)
 - a) Repeaters allow an additional wire run of 1640 feet (500m)
 - b) Dual-repeaters allow two additional wire runs of 1640 feet (500m)
 - 4) Link power wiring between stations shall not exceed 1313 feet (400m).

- e. The SPM shall support auxiliary power for certain remote devices, including touchscreen and interface stations, as required by the device.
 - 1) The auxiliary power network shall utilize polarity-dependent, low-voltage Class II wiring, consisting of two # 16 AWG wires.
 - 2) Auxiliary wiring shall permit a total wire run of 1640 feet (500m)
 - a) Repeaters allow an additional wire run of 1640 feet (500m)
 - b) Dual-repeaters allow two additional wire runs of 1640 feet (500m)
 - 3) The SPM shall supply 1.25 amps at 24v DC continuously.
4. Functional
 - a. Capacity
 - 1) Each SPM shall
 - a) Supply power for up to 32 button and button/fader stations.
 - Repeaters and dual-repeaters allow 30 additional stations, 62 total
 - b) Supply auxiliary power for a similar number of interface stations.
 - c) Shall supply auxiliary power for up to four Touchscreen stations, when a like number of other stations are deducted from the total.
 - Repeaters and dual-repeaters allow two additional Touchscreens (six total) when a like number of other stations are deducted from the total.
 - b. Operation
 - 1) The SPM shall not require configuration or programming.
 - 2) The SPM shall automatically detect faults in the wiring, indicate the fault, including the fault polarity, and shut down the output power.
 - a) The SPM shall automatically reset when the fault is clear, and can be manually reset by removing and re-inserting the module.

2.3 UNISON ERN SERIES CONTROL ENCLOSURES

A. Control Enclosures

1. The control enclosure shall be the Unison ERn Series Control Enclosure as manufactured by Electronic Theatre Controls, Inc., or equal.
2. Mechanical
 - a. The External Processing enclosure shall be a surface mounted panel constructed of 18 gauges formed steel panels with a hinged, lockable full-height door containing an integral electrostatic air filter.

- 1) The enclosure door shall have an opening to allow limited access to the control module face panel.
 - 2) Enclosures shall be convection cooled without the use of fans.
- b. Control Enclosures shall be sized to accept one or two Control Processors and one or two Station Power Modules, including various options and accessories.
- 1) The Control Enclosure for a single control processor (ERn2) shall support a single Station Power Supply module; the Control Enclosure for two control processors (ERn4) shall support a quantity of two modules.
- c. All enclosure components shall be properly treated and finished.
- 1) Exterior surfaces shall be finished in fine textured, scratch resistant, powder based epoxy paint.
- d. Enclosure(s) shall also be available in a 19-inch Rack Mounted (RM) version.
- 1) Rack-mounted version shall have an independent enclosure suspension kit, with a full height, locking door/cover attached to the kit.
 - 2) Rack-mounted version shall have an opening to access the control module face panel, and openings to view indicators on option modules.
- e. Enclosure dimensions and weights (without modules) shall not exceed:
- 1) ERn2 - 15-inches wide x 9-inches high, 10-inches deep, 15 lb.
 - 2) ERn2-RM - 19-inches wide 11-inches high 10-inches deep, 20 lb.
 - 3) ERn4 - 15-inches wide x 14-inches high x 10-inches deep, 20 lb.
 - 4) ERn4-RM - 19-inches wide x 16-inches high x 10-inches deep, 25 lb.
- f. Top, bottom, and side knockouts shall facilitate conduit entry.
- g. Enclosures shall be designed to allow easy insertion and removal of all control and option modules without the use of tools.
- 1) Supports shall be provided for precise alignment of modules into power and signal connector blocks.
 - 2) With modules removed, enclosures shall provide clear front access to all power and control wire terminations.
- h. Option Modules
- 1) Ethernet Switch
 - a) The Control Enclosure shall support an optional 5-port Ethernet Switch, with at least four ports supplying Power over Ethernet (PoE).
 - b) The Ethernet Switch module shall be 100BaseTX, auto MDI/MDIX, 802.3af PSE compliant.
 - c) The Ethernet Switch module shall contain power, status, and activity indicators. All indicators shall be visible when the enclosure door is open for both rack and wall mounted ERn.
 - 2) Redundant Power Supply (RRPS)

- a) The Control Enclosure shall support an optional redundant power supply which shall automatically provide power to the control electronics upon failure or removal of the primary power supply.
 - b) The redundant power supply shall assert itself seamlessly without a loss of power to the control electronics.
 - c) The redundant power supply shall seamlessly remove itself when the primary power supply is reengaged.
 - d) The redundant power supply shall provide visible indication that it is active.
- 3) Station Bus Repeaters (ERn4 only)
 - a) The Control Enclosure shall support an optional module to expand the station bus length an additional 400 meters, and the station count an additional 30 stations (60 maximum per processor/enclosure)
 - b) Wall-mount and 19-inch Rack-Mount versions shall also be available to support mid-span insertion away from the Control Enclosure.
 - 4) Station Bus Dual Repeaters (ERn4 only)
 - a) The Control Enclosure shall support an optional module to expand the station bus length to two additional 400 meter segments (a total of 1200 meters from a single enclosure, and the station count to 60 stations (60 maximum per processor/ enclosure).
 - b) Wall-mount and 19-inches Rack-Mount versions shall also be available to support mid-span insertion away from the Control Enclosure.
- i. Accessories
- 1) Ride thru Option (RTO)
 - a) The Control Enclosure shall support an optional, short-term back-up power source for the control electronics.
 - b) Ride Thru Option (RTO) provides power for controls electronics during brief power outages or drop outs.
 - c) The short-term back-up power source shall automatically engage upon the loss of normal power, seamlessly transitioning the supply power for the control electronics power to itself.
 - d) The short-term back-up power supply shall detect the return of normal power, and seamlessly return the control electronics to normal power.
 - e) The short-term back-up power source shall support the control electronics for at least 10 seconds.
 - 2) Battery Pack Option (BPO)
 - a) The Control Enclosure shall support an optional, long-term back-up power source for the control electronics.
 - b) The long-term back-up power source shall automatically engage upon the loss of normal power, seamlessly transitioning the supply power for the control electronics power to itself.

- c) The long-term back-up power source shall supply power to the control electronics for at least 90 minutes.
- d) The long-term back-up power supply shall detect the return of normal power, and seamlessly return the control electronics to normal power.
- e) A test switch/indicator shall be available without opening the rack door or removal of any modules/components.

3. Electrical

- a. External Processing enclosures shall be available in 100, 120, 230 and 240 volt, single-phase configurations.
- b. External Processing enclosures shall be completely pre-wired by the Manufacturer. The Contractor shall provide input and control wiring.
- c. External Processing enclosures shall be designed to support the following wire terminations:
 - 1) AC (single phase)
 - 2) Echelon link power (Belden 8471 or equivalent)
 - 3) 24Vdc (2- 16AWG Wire)
 - 4) DMX512A Port A (In or Out) (Belden 9729 or equivalent)
 - 5) DMX512A Port B (In or Out) (Belden 9729 or equivalent)
 - 6) RS232 Serial In/Out (Belden 9729 or equivalent)
 - 7) Unshielded Twisted Pair (UTP) Category 5 Ethernet
 - 8) Contact Closure In (14AWG to 26AWG Wire)
 - 9) Contact Closure Out (14AWG to 26AWG Wire)
 - a) Contact Closure Out shall provide 1A at 30vDC
- d. Station Power Modules
 - 1) Station power supply modules shall provide LinkPower for at 32 stations and 1.5A at 24VDC of Auxiliary (AUX) power.
 - 2) Station power repeater modules shall provide LinkPower for 30 stations and 1.5A at 24VDC of Auxiliary (AUX) power.
 - 3) Station power module shall support over-current/short protection for LinkPower and Aux. LinkPower shall support fault detection on each leg of the balanced data bus.
- e. All control wire connections shall be terminated via factory provided connectors.

4. Thermal

- a. Ambient room temperature: 0-40°C / 32-104°F
- b. Ambient humidity: 10%-90% non-condensing

2.4 TOUCHSCREEN CONTROL STATIONS

- A. The Touchscreen Control Stations shall be the Unison Paradigm Touchscreen P-TS7 Series Control Stations as manufactured by ETC, Inc., or equal.

B. General

1. Touchscreen stations shall support default and fully graphical control pages.
2. The Touchscreen station shall operate using graphic buttons, faders and other images on at least 30 separate programmable control pages.
3. Touchscreen stations shall also allow programming of page Pass-Code, lock out and visibility levels.

C. Mechanical

1. Touchscreen stations shall consist of a seven inch, backlit Liquid Crystal Display (LCD) with a minimum resolution of 800 by 400 pixels and 24-bit color depth with a capacitive touch interface.
2. Touchscreen bezels shall be constructed of cast aluminum finished in a fine texture powder coat.
 - a. Touchscreen shall be available in five standard colors
 - 1) Cream (RAL 9001)
 - 2) Ivory (RAL 1015)
 - 3) Gray (RAL 7001)
 - 4) Black (RAL 9004)
 - 5) Signal White (RAL 9003)
 - b. The bezel shall have no visible means of attachment.
 - c. The bezel shall allow the touchscreen to be installed and removed without the use of tools
 - d. The bezel shall provide two working positions for the Touchscreen: service and normal operation.
3. Touchscreen shall offer optional hinged locking covers
 - a. Locking covers shall be made from cast aluminum and be painted to match standard touch-screen color options
 - b. Locking covers shall allow for viewing of system status on the touchscreen though a smoked Lexan window
4. The Manufacturer shall provide back boxes for all LCD stations.
 - a. Flush back box for Touchscreens with or without locking covers shall be 7.94-inches wide x 5.33-inches high x 3.25-inches deep

D. Electrical

1. Touchscreens shall be powered entirely by the System network.
2. Touchscreens shall connect to the System using an Ethernet network with Power over Ethernet (PoE) or the Unison control station Echelon® Link power network.
 - a. Ethernet Network
 - 1) Ethernet network shall be 10/100BaseTX, auto MDI/MDIX, 802.3af (PoE) compliant.
 - 2) Network shall utilize Unshielded Twisted Pair (UTP) Category 5, or better wiring.
 - 3) PoE power consumption shall be PoE Class 2, consuming no more than 6 watts.
 - b. Echelon® Link power network.

- 1) Link power shall utilize low-voltage Class II unshielded twisted pair, type Belden 8471 or equivalent, and one #14 ESD drain wire (when not installed in grounded metal conduit).
- 2) Touchscreen stations shall also require two #16 AWG stranded wires for 24Vdc operating power. 24Vdc wiring shall be topology free.
- 3) Network wiring may be bus, loop, home run, star or any combination of these.
- 4) Network insulation displacement connectors shall be provided with all stations.

E. Functional

1. System

- a. The Touchscreen shall support configuration firmware upload from a Paradigm Processor as proxy
- b. The Touchscreen shall support configuration or firmware upload from local removable media

2. Setup Mode

- a. There shall be a setup display that is separate from any user-defined configuration
- b. It shall be possible to view and modify connectivity settings
- c. It shall be possible to view status information
- d. It shall be possible to view and modify LCD screen settings
- e. It shall be possible to perform Touchscreen calibration
- f. It shall be possible to view and modify audio settings
- g. The appearance of the setup display shall be standard and not editable
- h. The setup display may be invoked from within the user-defined configuration and/or physical button on the Touchscreen
- i. There shall be a default protected method to invoke the setup display

3. Configurations

- a. It shall be possible to have multiple configurations stored within an LCD Station
- b. Where multiple configurations are stored there shall be a boot menu to allow selection of a configuration

4. Operation

- a. The Unison Paradigm Control System shall be designed to allow control of lighting and associated systems via Touchscreen controls. System shall allow the control of presets, sequences, macros and time clock events.
 - 1) System presets shall be programmable via Button, Button/Fader, Touchscreen, or Light-Designer software.
 - a) Presets shall have a discrete fade time, programmable from zero to 84,600 seconds with a resolution of one hundred milliseconds.
 - b) Presets shall be selectable via Touchscreen stations.
 - 2) System macros and sequences shall be programmable via Light-Designer system software.
 - a) Macro and sequence steps shall provide user selectable steps, and allow the application of conditional logic.

- b) Macro and sequences shall be activated by button, time clock event or Light-Designer software.
- 3) System time clock events shall be programmable via the Touchscreen, LightDesigner system software, the processor user interface, or the internal web server.
 - a) Time clock events shall be assigned to system day types. Standard day types include: anyway, weekday, weekend, Sunday, Monday, Tuesday, Wednesday, Thursday, Friday and Saturday. System shall support programming of additional custom or special day types.
 - b) Time clock events shall be activated based on sunrise, sunset, time of day or periodic event. System shall automatically compensate for regions using a fully configurable daylight saving time.
- 4) A Color picker, supporting Hue, Saturation and Brightness (HSB) color selection shall be available for color selection of color changing fixtures and provide visual feedback of the current color produced by the associated fixture.
 - a) The color picker shall be provided with a default layout that requires no user configuration
 - b) The Color Picker shall provide RGB faders in addition to the default HSB color wheel for color selection
 - c) Color picker values shall allow for numerical value input in addition to color wheel and fader control
 - d) The color picker shall be compatible with color mixing systems that use up to seven discrete color control channels
- b. Touchscreen stations shall be designed to operate standard default or custom system functions. Components shall operate default functions unless re-assigned via LightDesigner, the Windows-based configuration program.
 - 1) Optional button functions include: preset selection, manual mode activation, record mode activation, station lockout, raise, lower, macro activation, and cue light, or room join/separate.
 - 2) Optional fader functions include master control, individual channel control, fade rate control or preset master control.
- c. Touchscreen stations shall allow programming of station and component electronic lockout levels via LightDesigner.
- d. It shall be possible to adjust LCD contrast and brightness.
- e. It shall be possible to program the station to dim during periods of inactivity.

2.5 PORTABLE PLUG-IN STATIONS

A. Portable Plug-in Stations

1. The Lighting Control Stations shall be the Unison Heritage UH Series Control Stations as manufactured by Electronic Theatre Controls, Inc., or equal.
2. Mechanical
 - a. Unison connector stations shall provide an interface to portable Unison stations.
 - b. All connector stations shall be available with white, cream, ivory, gray or black faceplates.
 - 1) Manufacturer's standard colors shall conform to the RAL CLASSIC Standard.
 - c. All faceplates shall be designed for flush or surface mounting.
 - d. Station faceplates shall be constructed of ABS plastic and shall use no visible means of attachment.
 - e. Station faceplates shall be indelibly marked with station function.
 - f. The Manufacturer shall supply back boxes for all surface mounted stations.
3. Electrical
 - a. Unison control station wiring shall be an Echelon® Link power network.
 - 1) Link power shall utilize Low-Voltage Class II unshielded twisted pair, type Belden 8471 or equivalent, and one #14 ESD drain wire (when not installed in grounded metal conduit).
 - 2) Portable plug-in stations shall also require two #16 AWG stranded wires for 24Vdc operating power. 24Vdc wiring shall be topology free.
 - 3) Network wiring may be bus, loop, home run, star or any combination of these.
 - 4) Wiring termination connectors shall be provided with all stations.
 - b. Portable Plug-in Stations shall offer the following Regular markings
 - 1) UL and cUL Listed
 - 2) CE Market
 - 3) RHoS and WEE Compliant
4. Functional
 - a. The Unison Paradigm Control System shall be designed to allow control of lighting and associated systems via Button, Button/Fader, and Interface or Astronomical time clock controls. System shall allow the programming of presets, sequences, macros and time clock events.
 - 1) System presets shall be programmable via Button, Button/Fader, Touchscreen, or Light-Designer software.
 - a) Presets shall have a discrete fade time, programmable from zero to 1,000 hours with a resolution of one millisecond.
 - b) Presets shall be selectable via button, fader, IR transmitter, time clock event, macro activation or switch interface stations.
 - i. System macros and sequences shall be programmable via LightDesigner system software.

- Macro and sequence steps shall provide user selectable steps, and allow the application of conditional logic.
 - Macro and sequences shall be activated by button, time clock event or LightDesigner software.
- ii. System time clock events shall be programmable via LightDesigner system software, the processor user interface, or the internal web server.
- Time clock events shall be assigned to system day types. Standard day types include: anyway, weekday, weekend, Sunday, Monday, Tuesday, Wednesday, Thursday, Friday and Saturday. System shall support programming of additional custom or special day types.
 - Time clock events shall be activated based on sunrise, sunset, time of day or periodic event. System shall automatically compensate for regions using a fully configurable daylight saving time.
- b. Control components shall be designed to operate default or custom system functions. Components shall operate default functions unless re-assigned via LightDesigner, the software-based configuration program.
- 1) Optional button functions include: preset selection, manual mode activation, record mode activation, station lockout, raise, lower, macro activation, or room join/separate.
 - 2) Optional fader functions include manual master control, individual zone control, fade rate control or preset master control.

D. Locking Covers

1. The Lighting Control Station Locking Covers shall be the Unison Heritage UH Series as manufactured by Electronic Theatre Controls, Inc., or equal.
2. Mechanical
 - a. Locking covers shall be available in Sliding Locking for flush mount applications and Hinged Locking for flush and surface mount applications
 - b. Sliding Locking Covers shall
 - 1) Be available with white, cream, ivory, gray or black faceplates.
 - 2) Be constructed of Extruded Aluminum with ABS plastic end caps
 - 3) Provide a smoked Plexiglas window to allow for viewing control status and use of IR remote without opening cover
 - c. Hinged locking covers shall:
 - 1) Be available in standard black powder coat finish
 - 2) Be constructed of 18 gauge steel and finished in standard black powder coat paint, or custom color as specified.
 - 3) Provide a clear Plexiglas window to allow for viewing control status and use of IR remote without opening cover
 - 4) Use internal Hinge that is not accessible when the cover is closed
 - d. Standard colors shall conform to the RAL CLASSIC Standard.
 - e. Locking covers of the same type shall be keyed alike
 - f. The Manufacturer shall supply back boxes for all hinged locking covers

3. Functional

- a. All locking covers shall utilize 90-degree locking mechanisms
 - 1) Keys shall be held captive in locks when covers are unlocked.
- b. Locking covers shall allow for easy viewing of system status without opening the cover
- c. Locking covers shall support IR remote activation of configured system functions without opening door

2.6 DATA PLUG-IN STATIONS

A. General

1. The Plug-in Stations shall consist of the appropriate connectors required for the functional intent of the system. These stations shall be available with DMX input or output, Remote Focus Unit, Network, or architectural control connectors. Custom control connectors shall be available.

B. Connector Options

1. The following standard components shall be available for Plug-in Stations:
 - a. 5-Pin male XLR connectors for DMX input
 - b. 5-Pin female XLR connectors for DMX output
 - c. 6-Pin female XLR connectors for RFU and ETCLink connections
 - d. RJ45 connectors for Network connections - Twisted Pair
 - e. 6-Pin female DIN connectors for Unison connections
 - f. DB9 female serial connector for Architectural Control from a computer

2. Custom combinations and custom control connections shall be available.

C. Physical

1. Station faceplates shall be .80-inch aluminum, finished in fine texture, scratch-resistant black powder coat. Silk-screened graphics shall be white.
2. The station panel shall mount into an industry standard back box, depending on size and quantity of connectors. A terminal block shall be supplied for Contractor terminations.

2.7 WALL MOUNT RELAY PANEL AND LOAD CENTER

A. General

1. The wall mount relay panel shall be the Echo Relay Panel as manufactured by ETC, Inc., or equal.
2. Relay Panels shall be UL508, UL67, and UL924 Listed, and shall be so labeled when delivered.
3. Relay Panels shall consist of a main enclosure with 30 pole breaker subpanel, relay/dimmer sub panel, integral control electronics, and a low voltage subpanel for data terminations and provision for accessory cards
 - a. Up to three accessory cards shall be supported per relay panel

B. Mechanical

1. The panel shall be constructed of 16-gauge steel. All panel components shall be properly treated and finished in fine-textured, scratch resistant paint.
2. Relay panels shall be available in 120 and 277 Volt AC configurations
 - a. 120V enclosures shall be 67.5-inches high by 14.36-inches wide and 4-inches deep with a weight not more than 80 pounds.
 - b. 277V enclosures shall be 67.5-inches high by 20-inches wide and 6-inches deep with a weight not more than 130 pounds.
3. The panel shall be capable of being mounted on the surface of a wall or recessed mounted.
 - a. 120VAC panels shall support mounting between standard wall stud framing (16-inches on center spacing).
4. Choice of panel covers shall be available for surface or recess mount applications. This outer panel shall ship complete with a locking door to limit access to electronics and breakers, breakers.
 - a. Optional center-pin reject security screws shall be available for all accessible screws.
 - b. Recess mount doors shall extend 1-inch beyond all panel edges to hide wall cut-out
5. The unit shall provide interior cover over breaker panel to allow access only to Class-2 wiring and prevent direct access to Class 1 line voltage components.
6. The Relay panel shall support up to twenty-four 20-amp single pole circuits made up of relays or 300W phase-adaptive dimmers
 - a. Two-pole and 3-pole relay circuits shall be supported at decreased density where each pole constitutes one of the available single-pole circuits. Mixing of circuits in any combination shall be supported.
7. Relays shall include integral switches for manual control while power is unavailable to the panel such that critical lighting can be set to an on state, without the need for power to the panel.
8. Relay output lugs shall accept 6-14AWG copper wire
9. Breaker subpanel may include up to twenty-nine 20-amp single pole, up to fourteen 20-amp double pole, or nine 3-pole breakers as required in any combination up to capacity
10. Control wiring for DMX, station bus, and Emergency input terminations shall land on removable headers for Contractor installation.

C. User Interface

1. The user interface shall contain a graphical display with button pad to include 0-9 number entry, up, down back arrow navigation and enter.
2. Test shortcut button shall be available for local activation of preset, sequence and set level overrides.
3. The user interface shall have a power status LED indicator (Blue), a DMX status LED indicator (Green), a network status LED indicator (Green) and an LED indicator (red) for errors.
4. Interface shall allow the backlight to timeout and shall provide user editable options to shut off backlight completely as well as adjust screen contrast.
5. Ethernet interface (when installed) shall default to automatic IP through link local and DHCP. Upon receiving IP address, the address of the Network Interface Card (NIC) shall display in the about menu. Static address and settings shall also be possible.

6. The control interface shall support a USB memory stick interface for uploads of configurations and software updates

D. Functional

1. Panel setup shall be user programmable. The control interface shall provide the following relay setup features (per circuit):
 - a. Type (1 pole, 2 pole, or 3 pole)
 - b. Name
 - c. Circuit Number
 - d. DMX address
 - e. sACN address (network enabled panels only)
 - f. Space Number
 - g. Circuit Mode
 - 1) Normal (priority and HTP based activation and dimming)
 - 2) Latch-lock
 - 3) Fluorescent
 - 4) DALI
 - h. On threshold level
 - i. Off threshold level
 - j. Include in UL924 emergency activation
 - k. Allow Manual
2. Relay panels shall support discrete addressing of each relay. Panels that are restricted to use of start address with sequential addressing and cannot assign each 0-10V output control to any internal relay shall not be acceptable
3. The panel shall be capable of switching all relays on or off at once, or in a user-selectable delay per relay using a period of 0.1 to 60 seconds, in 0.1 second increments
4. Control electronics shall report the following information per branch circuit:
 - a. Breaker state (On/Off)
 - b. Relay state (Open/Closed)
 - c. Current draw (In Amps)
 - d. Voltage
 - e. Energy usage
5. Built in Control shall include:
 - a. Ability to record up to 16 presets in each space from the control panel, connected control stations, or timed events
 - b. Presets shall be programmable by recording current levels (as set by DMX or connected control stations), by entering levels on the control panel directly, manually selecting relay state on each relay or a combination of these methods. From the control panel, stations, or timed events it shall be possible to record values for up to 16 zones per space.
 - c. Up to eight spaces in a single rack for total of up to 16 spaces shall be supported per system or system subne.
 - d. Indication of an active preset shall be visible on the control panel display.
 - e. One 16-step sequence per space for power up and power down routines

- f. The panel shall have a UL924-listed contact input for use in Emergency Lighting systems. The panel shall respond to the contact input by setting included relays to "on", while setting non-emergency relays "off". Each relay can be selected for activation upon contact input.
 - g. Upon Data loss the system shall provide options to hold last look infinitely or hold for a configured time period set by the installing technician then fade/switch to the input of the next available priority.
 - h. Control electronics shall respond directly to control stations for zone, preset, and sequence control. Systems that require secondary control systems for this functionality are not acceptable.
 - i. After power loss, electronics shall be capable of holding the system in its previous state until new level data (DMX, Architectural presets, sequences and zones, or local overrides) is received to make each relay change state.
6. The control of lighting and associated systems via real time and astronomical clock controls.
- a. The relay panel shall allow the activation of presets, sequence, and zone programming of up to 50 time clock events via a built in real and astronomical timeclock.
 - b. System time events shall be programmable via the control panel.
 - 1) Time clock events shall be assigned to system day types. Standard day types include: everyday, weekday, weekend, Sunday, Monday, Tuesday, Wednesday, Thursday, Friday and Saturday.
 - 2) Time clock events shall be activated based on sunrise, sunset, time of day or periodic event.
 - 3) System shall automatically compensate for regions using a fully configurable daylight saving time.
 - 4) Presets shall be assigned to events at the time clock.
 - c. The time clock shall support event override
 - 1) It shall be possible to override the timed event schedule from the face panel of the time clock
 - d. The time clock shall support timed event hold
 - 1) It shall be possible to hold a timed event from the face panel of the processor
 - 2) Timed event hold shall meet California Title 24 requirements
7. The panel shall receive ESTA DMX512-A control protocol. Addressing shall be set via the user interface button keypad with any relay being patched to any DMX control address
- a. 2,500V of optical isolation shall be provided between the DMX512 inputs and the control electronics as well as between control and power components.
 - b. The relays shall respond to control changes (DMX or Stations) in less than 25 milliseconds. DMX512 update speed shall be 40Hz.
 - c. Setting changes shall be able to be made across all, some, or just one selected relay in a single action from the face panel
 - d. DMX data loss shall allow for levels/relays to be held for ever or for a specified time before switching to a lower priority source
 - e. Initial Panel setup
 - 1) The relay panel shall automatically detect the type of relay or dimmer installed in each location without need for manual configuration of the physical arrangement.

- 2) Quick rack setup shall be available to apply address settings across all circuits for rack number, DMX Start Address, sACN universe, and sACN start address.
- 3) Emergency Setup Menu shall provide optional delays when emergency is activated or deactivated, and option to turn off non-emergency circuits shall be available. Record function shall allow circuits that are turned on to be added to the emergency setting.

E. Electrical

1. Relay Panels shall be available to support power input from:
 - a. 120/208V three phase 4-wire plus ground
2. Conduit Entry:
 - a. Feeders:
 - 1) Top or top-side (upper 6-inches of either side)
 - 2) Bottom or bottom-side 6-inches of either side
 - 3) Feeders shall enter through the top or bottom according to the orientation of the enclosure.
 - 4) Feeder entry shall be nearest to the location of the feeder lugs or main breaker.
 - b. Load:
 - 1) Load wiring shall enter through the top or bottom of the enclosure.
 - 2) Load wiring shall enter through the top/bottom surface nearest to the breaker sub panel.
 - 3) Load wiring may also enter through left and/or right side provided a low voltage chase is not required through the same area. If Class 2 chase is required, a field installable barrier panel shall be provided upon request. When installed, the left or right side of the panel, where the barrier has been installed, shall not permit load wiring.
 - c. Low Voltage:
 - 1) Top or top-side (upper 6-inches of either side)
 - 2) Bottom or bottom-side (bottom 6-inches of either side)
 - 3) For low voltage conduit entry at the relay end of the cabinet, conduits shall be located at the outer 3-inches of the top/bottom panel.
 - 4) Field installed low voltage channel shall be provided separately for installation on the left or right side of the panel to allow Class 2 wiring to traverse the panel from top to bottom or bottom to top.
3. All relays shall be mechanically latching
4. The relay shall be capable of switching 20-amp at up to 300V
5. The relay panel shall support a maximum feed size of 200 Amps
6. Relay panels shall support main circuit breaker options:
 - a. Main breaker options shall be optional and available for purchase upon request
 - b. Main breakers shall be field installable
 - c. Main breakers shall be available in 100-amps and 200-amps for 120V systems and 150 amps for 277V systems
 - d. Series rated SCCR ratings apply as follows with appropriate main breaker:

- 1) 22,000A at 120/240V
- 2) 10,000A at 100A; 120/208V
- 3) 10,000A, 22,000 or 42,000 at 200A; 120/208V
- 4) 14,000A at 150A and 200A; 277V/480V
- 5) 65,000A at 200A; 277V/480V

e. Main breakers shall allow the following range of wire sizes:

- 1) 1AWG-300kcmil at 120/240V
- 2) 3/0 to 300kcmil at 120/208V
- 3) 6AWG-300kcmil at 277V/480V

F. Relay

1. Each relay shall have a manual override switch with on/off status indication.
2. Relays shall be rated for use with:
 - a. 20A 277V Ballast (HID)
3. 16A Electronic Ballast loads at 120, 240 and 277V
4. 20A Tungsten loads at 120, 240, and 277V
5. Motor loads with ratings of 20 FLA at 120V, 17 FLA at 240V, and 14 FLA at 277V 100,000A symmetrical SCCR
6. Isolation: 4000V RMS shall use latching state relays
7. Rated Life:
 - a. 1,000,000 mechanical activations
 - b. 100,000 cycles at full resistive load
 - c. 30,000 cycles full motor, inductive, tungsten, and electronic (LED)
 - d. Decreasing loading shall increase the rated life of the relay inversely proportional the square of the load
8. Shall support reporting of current usage with an accuracy of 5% of the connected load

G. Relay Panel Accessories

1. Ethernet Option shall provide advanced control of relays over streaming ACN (sACN) and transmit status, control override, and measured energy usage per branch circuit to web browser based interface or central monitoring interface
2. A Low Voltage 0-10V Dimming Option shall link each of the 24 0-10V outputs with a relay circuit in the panel. Each output shall support up to 400mA of current sink for support of at least 50 LED drivers of fluorescent ballasts
3. A Contact Input Option shall allow 24 dry contact inputs to be linked for direct or group relay control, to activate a preset, or to activate a sequence. Controller software shall allow for normally open maintained, normally closed maintained or momentary toggle.
4. A DALI Control Option shall provide 24 control loops of broadcast DALI control with each loop controlling up to 64 ballasts.
5. A Ride Thru Option shall provide short-term power backup of control electronics by automatically engaging when power is lost, and recharging when normal power is present
6. A Tamperproof Hardware Kit shall include center reject Torx head screws to prevent access to panel interior by unqualified individuals
7. Main Breaker options shall be available as shown in Section G.2

H. Thermal

1. The panel shall be convection cooled. Panels that require the use of cooling fans shall not be acceptable.
2. The panel shall operate safely in an environment having an ambient temperature between 32°F (0°C) and 104°F (40°C), and humidity between 5%-95% (non-condensing).

2.8 POWER DISTRIBUTION – OUTLET AND PIGTAIL BOXES

A. General

1. Connectors shall be available as 20-amp, 50-amp and 100-amp grounded stage pin, 20-amp twist lock and 20A "U" ground (dual rated "T-slot"); other connectors shall be available as specified.
2. Pigtails shall be three-wire type "SOW" rubber jacketed cable sized for the maximum circuit ampacity.
3. Pigtails with 20 amp stage pin connectors shall be terminated using 12 gauge 4 way indent crimp (with inspection window) type where the wire is inserted and crimped directly in the socket.
4. Terminations for pigtail connectors shall utilize feed-through terminals individually labeled with corresponding circuit numbers.
 - a. 20 amp circuits shall use screw-less tension clamp terminals listed for 20 – 8 gauge wire.
 - b. 50 amp circuits shall use compression terminals listed for 10 – 1 gauge wire.
 - c. 100 amp circuits shall use compression terminals listed for 8 – 2/0 gauge wire.
 - d. Terminals that place a screw directly on the wire are not acceptable.
5. Outlet and pigtail boxes shall be supplied with appropriate brackets and hardware for mounting as shown on the Drawings
 - a. Standard mounting options shall include pipe or wall mounting
 - b. Brackets shall be made from ASTM A 36 steel
 - c. Hardware shall be ASTM A307 grade 5.
6. A low voltage distribution system shall be available to incorporate DMX, Ethernet or other protocols as specified in the power distribution box.
 - a. A voltage barrier shall be used to separate the low voltage wiring for the electrical circuits.
7. Power distribution equipment shall be listed by a Nationally Recognized Test Lab (NRTL).

B. Physical

1. Outlet and pigtail boxes shall be 6.25-inches H x 3.3-inches D and fabricated from 18 gauge galvanized steel and finished in black fine-texture powder coat paint.
 - a. Covers shall be fabricated from 16-gauge galvanized steel
2. Outlet and pigtail boxes shall be available in any length specified in increments of 3-inches with a maximum length of up to 3-feet.
3. Pigtails and outlets shall be spaced on 18-inches centers, or as otherwise specified.
4. Outlets shall be mounted on individual 3-inches panels.
5. Circuits shall be labeled with 1.25-inch lettering.

- a. Circuit labeling options shall include:
 - 1) Circuits shall be labeled on the front side of the connector strip with white lettering on black background labels.
 - 2) Circuits shall be labeled on front and back sides of the connector strip with white lettering on black background labels.
 - 3) Circuits shall be labeled on the front side of the connector strip with engraved lamacoid labels utilizing white lettering on black background labels.
 - 4) Circuits shall be labeled on the front and rear sides of the connector strip with engraved lamacoid labels utilizing white lettering on black background labels.
 - 5) Circuits shall be labeled on one side of the connector strip using individual circuit cover plates with lettering engraved in the cover and filled with the specified color.
 - 6) Circuits shall be labeled using specified labeling per Plans and Drawings
6. Outlet and pigtail boxes shall support optional LED indicators to indicate the presence of power at each local circuit. The indicator shall be red in color and mounted in outlet or pigtail box.
 - a. The LED indicator shall be mounted in the lower right corner of the outlet panel
 - b. The LED indicator shall be mounted in the bottom of the outlet or pigtail box directly below the outlet panel.
 - c. The LED indicator shall be mounted in the cover plate directly below the circuit label for pigtail circuits

2.9 GENERAL NETWORK

A. General

1. The Electronic Theatre Controls Net3 network shall provide data distribution over TCP/IP Ethernet networks. Data shall be layer 3 routable. Systems using proprietary formats or formats other than 10/100/100Mbit wired Ethernet or non-layer 3 routable networks shall not be accepted.
2. Connections shall be made between consoles, face panels, architectural processors, dimmers, Net3 Gateways, and computers over standard Ethernet distribution systems using 100BaseT, 100BaseFL, or greater wiring. All installations shall conform to establish Ethernet wiring practice, and installation shall be performed by Contractors qualified to do this type of work. All wiring shall be tested at Category 5e or higher for full bandwidth operation to the appropriate IEEE standard.
3. The Lighting Control system must be supplied by a single Manufacturer and must have seamless integration over Ethernet between the Entertainment and Architectural lighting control.

B. Capacities

1. The network shall support DMX routing, patching, and prioritization for up to 63,399 universes (32,767,488 DMX addresses). Each address may be input or output from any port on any DMX gateway in the system. DMX input, routing and output shall be specifically supported on the system from multiple sources and locations up to the maximum number of gateways supported by the Ethernet topology.
2. The network shall support multiple network hosts including consoles, gateways, dimming racks, computers, file servers, printers, and architectural control processors with discrete command lines and control. The lighting network shall support multiple venues within a system and discrete systems on the same network.

C. System Configuration and Monitoring

1. Network device configuration shall be via Net3 Gateway Configuration Editor (GCE) software and/or ANSI E1.17 Architecture for Control Networks (ACN).
2. Patch addresses shall support viewing and manipulation via ANSI E1.17 ACN.
 - a. The system shall permit complete user flexibility allowing the system operator to patch each DMX input address to any ANSI E1.31 streaming ACN address, and DMX output to span streaming ACN universes.
 - b. The lighting system shall support assignment of DMX offsets, truncation of DMX universes, and provide choice of DMX port prioritization.
 - c. The lighting system shall support the DD start code extension to ANSI E1.31 which provides priority per address such that multiple control sources can share universes with discrete control per address.
 - d. Lighting systems that do not support the above mentioned address patching capabilities shall not be suitable.
3. The system shall allow assignable labels for all network devices to allow easy identification by system users.
4. Each network device shall have a discrete and unique IP address provided automatically by the software. The user may edit this IP address. Systems that do not support automated IP allocation with IP collision avoidance, and systems that do not allow complete reconfiguration of the above mentioned features over ANSI E1.17 ACN shall not be acceptable.
5. All configuration data for each network device shall be held at the device and system operation shall not require continuous on-line operation of the network configuration software.
6. Lighting console operators shall be able to back up the network configurations in the lighting control console. In the event of a network device failure, the operator shall be able to apply the configuration of the failed device to a replacement device of the same type without manually reentering settings. Systems that do not support configuration backup as described above shall not be accepted.
7. Architectural and Entertainment systems connected to the same network shall be capable of arbitrating control over E1.31 Streaming ACN (sACN) level data. The system shall be capable of alternating control of individual address data between architectural and entertainment systems without intervention by the user. The user shall dictate the conditions under which system shall automatically take control. The network shall allow user override of the selected defaults. Systems which require direct user intervention to allocate control of dimmers between architectural and entertainment lighting systems shall not be accepted.
8. The Net3 network shall allow multiple DMX input sources to be prioritized on the same universe as network native sources using E1.31 Streaming ACN prioritization. Multiple DMX inputs may be assigned to the same streaming ACN address (this provides multi-source control for a particular address). Likewise, the system shall support E1.31 prioritization of multiple simultaneous network sources. Systems that cannot prioritize multiple DMX inputs and multiple native network sources on a network shall not be deemed suitable.
9. The lighting network shall allow each DMX input address to be assigned a priority on the network allowing each DMX control level coming into the system to participate in full arbitration. Addresses with the highest priority shall have control, with lower priority addresses being ignored. Addresses assigned the same numeric priority, between 1 and 200, shall respond in highest level takes precedence (HTP) manor. The network shall require a valid DMX signal present at the input to initiate prioritization. Systems that do not allow for prioritized HTP for DMX inputs to the network shall not be allowed.

D. Operational Features

1. Each DMX gateway shall control up to 512 DMX addresses per port, within the confines of up to 63,999 DMX universes (32,747,488 addresses). The specific DMX data input or output by the gateway shall be configurable by the user.
2. Duplicate outputs of DMX data (DMX splitter) and discrete outputs shall be fully supported.

3. Merging of multiple DMX input sources on a single gateway without gateway with DMX output on the same gateway shall be supported without connection to the network. The gateway shall support assignment of priority to each input source independently
4. File transmission, synchronization and access to software shall be supported.

2.10 DMX GATEWAY – FOUR-PORT

A. General

1. The lighting control gateway shall be a microprocessor-based unit specifically designed to provide DMX-512 control of lighting systems and transport of RDM configuration and status messages. The gateway shall permit DMX-512 data to be encoded, routed over an Ethernet network and decoded back to DMX-512. The unit shall be a Net3 DMX 4-port Gateway as provided by ETC, Inc.
2. Gateways shall communicate over Ethernet directly with at least ETC, Inc.'s entertainment and architectural lighting control products and other Ethernet interfaces.
3. Connections shall be made between Gateways, consoles, Architectural systems, and PCs over standard Ethernet distribution systems using 10/100BaseT.
4. The Gateway shall support multiple protocols including:
 - a. ANSI E1.17 Architecture for Control Networks (ACN)
 - b. ANSI E1.31 Streaming ACN (sACN)
 - c. ANSI E1.11 USITT DMX512-A
 - d. ANSI E1.20 Remote Device Management (RDM)
5. The Gateway shall be tested to UL standards and labeled ETL Listed.
6. The Gateway shall be RoHS Compliant (lead-free).
7. The Gateway shall be CE compliant.
8. The Gateway shall have a backlit graphic LCD display for identification (soft-labeling) and status reporting.
 - a. Labeling shall be user configurable using ANSI E1.17 Architecture for Control Network (ACN), or a purpose built software configuration tool.
 - b. The LCD display shall show DMX port configuration indication as well as indicate the presence of valid signal.
 - c. Gateways that do not indicate port configuration (input/output) and valid data shall not be acceptable.
9. Each Gateway shall have power and network activity LEDs on both the front and rear of the Gateway

B. DMX Ports

1. DMX Ports shall comply with the requirements of ANSI E1.11 USITT DMX512-A standards.
2. Each DMX port shall be software-configurable for either input or output functionality.
3. Hardware configuration override setting shall be provided on the Gateway.
4. DMX input shall be optically-isolated from the Gateway electronics.
5. DMX output shall be earth-ground referenced.
6. DMX Port shall be capable of withstanding fault voltages of up to 250vAC without damage.
7. Each port shall incorporate one DMX512-A Connection
 - a. Each DMX port shall be modular and hot swappable

G. Network

1. Communications physical layer shall comply with IEEE 802.3i for 10BASE-T, 802.3u for 100BASE-TX and 802.3af for Power over Ethernet specifications
2. All network cabling shall be Category 5 (or better), conforming to TIA-568A/B, and shall be installed by a qualified Network Installer.
3. Data transport shall utilize the TCP/IP suite of protocols to transfer the DMX data.
4. ANSI E1.17 Architecture for Control Networks (ACN) and streaming ACN (sACN) shall be supported. Gateways that do not support ANSI E1.17 shall not be acceptable.
5. Switches shall comply with power-over-Ethernet IEEE802.3af, unless a separate in-line power supply is provided.
6. Multiple DMX signal routing patches and multiple facilities shall be supported and limited only by the file storage capacity of the computer with ETC Gateway Configuration Editor (GCE) Software installed.
7. Each DMX gateway shall control up to 512 DMX addresses, per DMX port within the confines of up to 64,399 universes (32,767,488 addresses) using Streaming ACN (sACN).
 - a. Any range of DMX addresses may be selected for each universe.
 - b. Multiple sources shall be supported by prioritized Highest Takes Precedence (HTP with priority). Each source shall support assignment of priority to allow override of default HTP behavior.
 - c. Each DMX port shall support its own universe and start address.
8. Gateways shall have built in DMX merger capability on a universe or channel-by-channel basis.
9. Gateways shall support have built in priority on a per-universe or channel-by-channel basis. Gateways that do not support prioritized merging of multiple network sources at independent priorities shall not be accepted.

H. DMX Connector modules

1. Each gateway shall support up to four connector modules containing a single DMX connector and its associated electronics
2. Connector module options shall include
 - a. Five-pin Male DMX connector for DMX Input
 - b. Five-pin female DMX connector for DMX output
 - c. RJ-45 Ethercon connector for DMX input or output
 - d. Eight position terminal connector for DMX input or output. Terminal connections shall support screw terminals or Insulation displacement (IDC) wire terminations.
3. Each connector module shall be optically-isolated from the Gateway electronics and from other DMX modules in the same gateway.
4. DMX connector modules shall be capable of withstanding fault voltages of up to 250vAC without damage.

I. Environmental

1. The ambient operating temperature shall be 0° to 40°C (32° to 104°F).
2. The storage temperature shall be -40° to 70°C (-40° to 158°F).
3. The operating humidity shall be 5% - 95% non-condensing.

J. Accessories

1. Hanging bracket kit shall allow unit to be mounted in three orientations

- a. U-Bolt or C-Clamp mounting hardware shall be available
2. One E.I.A. rack space mounting bracket kit shall support either one or two complete units and allow for up to eight ports of DMX
3. Front Access Panel kit shall allow the connectors on the rear of the Gateway to be accessed from the front of an equipment rack. Options for 5-pin XLR style connectors that support DMX input or output shall be available
4. A Universal Power Supply with international plug-set shall be available. Multiple power supplies shall be able to fit in a vertically stacked power strip.
5. ETC Net3 Concert Configuration and monitoring Software

K. System Requirements

1. Provide the quantity and type of Gateways required, as scheduled. Gateways and software shall be as manufactured by Electronic Theatre Controls Inc. of Middleton, WI.
2. Provide Ethernet switches and power supplies as scheduled and as shown on Drawings.
3. Provide a current generation PC with Windows 7 operating system equipped with a 10/100 Ethernet card.
4. Systems that do not provide the above capabilities shall not be acceptable

2.11 LIGHTING CONSOLE AND ACCESSORIES

A. General

1. The lighting control console shall be a microprocessor-based system specifically designed to provide complete control of stage, studio, and entertainment lighting systems. The console shall be the ColorSource 20 or ColorSource 40 as manufactured by Electronic Theatre Controls, Inc., or equal.
2. The system shall provide control of 512 DMX512A addresses on a maximum of forty or eighty control channels. Any or all of the DMX512A outputs may be controlled by a channel.
3. A maximum of 999 cues may be contained in non-volatile electronic memory.
4. Twenty or forty faders shall provide access to individual intensity channels, intensity for devices as well as playbacks.
5. Four configurable faders shall provide functionality for output of bump buttons, cue list control or crossfade control.
6. The console shall have one built-in 7-inch color multi-touch touchscreen. The touchscreen shall provide the primary interface for system configuration, programming show data and multi-parameter control.
7. Six soft-key buttons shall be provided, five of which may be configured by the user.
8. Console shall be equipped with an on-board help system, with on-board tutorial videos.
9. Console shall not require the use of an external monitor for normal use.
10. Console software upgrades shall be made by the user via USB drive. Changing internal components shall not be required.
11. The console shall provide a USB port allowing show data to be saved for archival or transfer to other consoles or a personal computer.
12. Systems that do not provide the above capabilities shall not be acceptable.

B. Controls and Playback

1. Patching

- a. The console shall provide patching facilities for dimmers and multi-parameter devices via a built in library of fixture definitions. The fixture library shall be updated via software based updates. It shall be possible to create custom fixture definitions using an offline application.
 - b. The console shall support patching, address setting, and mode changes using Remote Device Management (RDM) on the local DMX/RDM port.
2. Channel or Playback Faders
- a. Twenty or forty proportional, fully overlapping faders shall be provided with 45mm potentiometers and bump buttons.
 - b. The faders shall provide direct manual control of intensity for all channels. Channel levels can be changed at any time by using the individual channel faders or through the use of the touch screen interface.
 - 1) Faders shall also control up to ten pages of twenty (or forty) recordable memories or sequences. Memories shall record user-selected channel levels. Sequences shall record user-selected memories or channel levels.
 - a) With color mixing systems, output of color from fixtures shall appear to be a combination of the active memories in a color space.
3. Programming Tools
- a. The console shall provide a 7-inch color multi-touch touchscreen with six soft-keys, as well as touch-based controls. The LCD shall provide system configuration, programming show data and multi-parameter control.
 - b. Touch-based tools shall include:
 - 1) Forty programmable color chips and color picker.
 - 2) Touch-based parameter controls.
 - 3) Virtual Level/Rate wheel.
 - 4) Virtual keypad for level entry.
 - 5) Customizable channel display using Stage Map. It shall be possible to rearrange the graphical representations for control channels to closely mimic the positions of fixtures in the venue.
 - 6) Effects (intensity, color, shape, and parameter)
 - a) It shall be possible to assign multiple effects to the same channel and parameters. The playback of those effects shall play levels back relative to the combination of the two effects.
 - c. Fixture selection shall be made via:
 - 1) Auto fixture selection on fader moves.
 - 2) Pressing the selection button under channel faders.
 - 3) Touching the channel icon in the stage map display on the touch screen.
 - 4) Fixture Tags for Quick Selects
 - a) Selection of multiple fixture shall be possible through a special controls dock that groups channels together based on the channel tile positions within a pre-defined area in the topographical view for channels.

- b) Selection shall be possible through the use of informational tags. Selecting a predefined tag selects all fixtures sharing that same tag. At least two tags may be assigned to any one channel.
 - c) There shall be at least 27 Quick Select groupings.
 - d. Two independent channels shall be provided with on/off functionality. Independents shall be patched in a location separate from patch.
4. Playback Controls
- a. A cue list of up to 999 cues shall be provided. Cues may be made up of channel levels and parameter settings or contain a reference to a recorded memory. Cues shall be editable and shall be able to be individually deleted and inserted.
 - b. Playback Toy for filtered and timed execution of playbacks.
 - c. Multiple bump modes (Flash, Solo, SoloChange, Move/GO).
 - d. Full history rubber-banding for playbacks.
- C. Interface Options
- 1. The console shall provide connectors for the following:
 - a. 12V AC or DC input for external power supply
 - b. DMX512-A/RDM output (one 5-pin XLR connector)
 - c. USB connection (one type A connector)
- D. Physical
- 1. All operator controls and console electronics shall be housed in a single desktop console.
 - 2. Size and weight:
 - a. Twenty fader console shall be equal to or less than 18.31-inch (465mm) wide 11-inch (279mm) deep 2.36-inch (60mm) high (including controls), and 6.9 lbs. (3.13 kg.)
 - b. Forty fader console shall be equal to or less than 26.31-inch (668mm) wide 11-inch (279mm) deep 2.36-inch (60mm) high (including controls) and 9.55 lbs. (4.33kg).
 - 3. Twenty fader console shall be able to be mounted into a 19-inch equipment rack with the use of additional mounting hardware.
 - 4. Console power shall be 12V AC or DC via an external power unit. The power unit shall operate with 90-265VAC line voltage, 50 or 60Hz. Console is provided with a universal power supply.

PART 3 EXECUTION

3.1 INSTALLATION

- A. It shall be the responsibility of the Electrical Contractor to receive and store the necessary materials and equipment for installation of the dimmer system. It is the intent of these Specifications and Plans to include everything required for proper and complete installation and operation of the dimming system, even though every item may not be specifically mentioned. The Contractor shall deliver on a timely basis to other trades any equipment that must be installed during construction.

- B. The Electrical Contractor shall be responsible for field measurements and coordinating physical size of all equipment with the Architectural Requirements of the spaces into which they are to be installed.
- C. The Electrical Contractor shall install all lighting control and dimming equipment in accordance with Manufacturers approved Shop Drawings.
- D. All branch load circuits shall be live tested before connecting the loads to the dimmer system load terminals.

3.2 MANUFACTURER'S SERVICES

- A. Upon completion of the installation, including testing of load circuits, the Contractor shall notify the Dimming System Manufacturer that the system is available for formal checkout.
- B. Notification shall be provided in writing, 2-weeks prior to the time that Factory-Trained Personnel are needed on the job site.
- C. No power is to be applied to the dimming system unless specifically authorized by written instructions from the Manufacturer.
- D. The Purchaser shall be liable for any return visits by the Factory Engineer as a result of incomplete or incorrect wiring.
- E. Upon completion of the formal check-out, the Factory Engineer shall demonstrate operation and maintenance of the system to the Owners Representatives. Training shall not exceed 4-working hours. Additional training shall be available upon request.

3.3 WARRANTY

- A. Manufacturer shall warrant products under normal use and service to be free from defects in materials and workmanship for a period of 2-years from date of delivery.
- B. Warranty shall cover repair or replacement of such parts determined defective upon inspection.
- C. Warranty does not cover any product or part of a product subject to accident, negligence, alteration, abuse or misuse. Warranty does not cover any accessories or parts not supplied by the Manufacturer.
- D. Warranty shall not cover any labor expended or materials used to repair any equipment without Manufacturers prior written authorization.

END OF SECTION 265561
092319/212227

tBP PROJECT NO: 20998.00
ADDENDUM 03
SEPTEMBER 24, 2019

COMPTON COLLEGE
INSTRUCTIONAL BUILDING #2
COMPTON COMMUNITY COLLEGE DISTRICT

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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/EIA-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 - TTPMD 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:

Panduit, per Campus IT Standards.

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

<u>Abbreviation</u>	<u>Terminology</u>
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 IDF.....	Circuit interconnections between individual workstation outlet location to respective IDF or MDF equipment rack patch panel. 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 = 10 ⁻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 with 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. 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 arranged 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

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 \pm 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-entrant 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.

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) 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.

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:
- | <u>Quantity of Patch Ports</u> | <u>Quantity of Splice Drawers</u> | <u>Nominal Height</u> |
|--------------------------------|-----------------------------------|-----------------------|
| 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:
- | <u>Quantity of Thru Splices</u> | <u>Quantity of Splice Drawers</u> | <u>Nominal Height</u> |
|---------------------------------|-----------------------------------|-----------------------|
|---------------------------------|-----------------------------------|-----------------------|

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:

<u>Outlet Quantity</u>	<u>Nominal Patch Panel Height</u>
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 Suppressor (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.

C. 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 CPI, B-Line; or Saunders; or Hendry.

D. 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.

E. 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 insulated 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-6 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. "Poke-Thru".
 - a. Shall combine a computer/data and a telephone/ voice copper wire universal outlet connector in a duplex outlet in the 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.

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 workstation 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. 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 ODF 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-6, UTP 4-pair cable:
 - a. Each network workstation outlet location.
 - b. Each network "wireless-access-point" outlet location.
2. One Category-6, UTP 4-pair cable, for each telephone handset (instrument) workstation outlet location.
3. 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.

<u>Cable Type</u>	<u>Cable Fiber Quantity</u>	<u>Minimum Bend Radius</u>	<u>Maximum Pulling Tension</u>
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:

<u>Equipment Type</u>	<u>Minimum Separation</u>
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 #1 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.

3.8 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
 $(QFP) \times (QTO \times 4) + (\text{specified spares}) = \text{Minimum terminal block pair capacity.}$

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 1½-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-Environmental 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 1/8-inch thick 98% lead, approximately 2-inch square with chamfered corners. Two holes shall be drilled for attachment to primary cable. Lettering shall be 1/8-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:

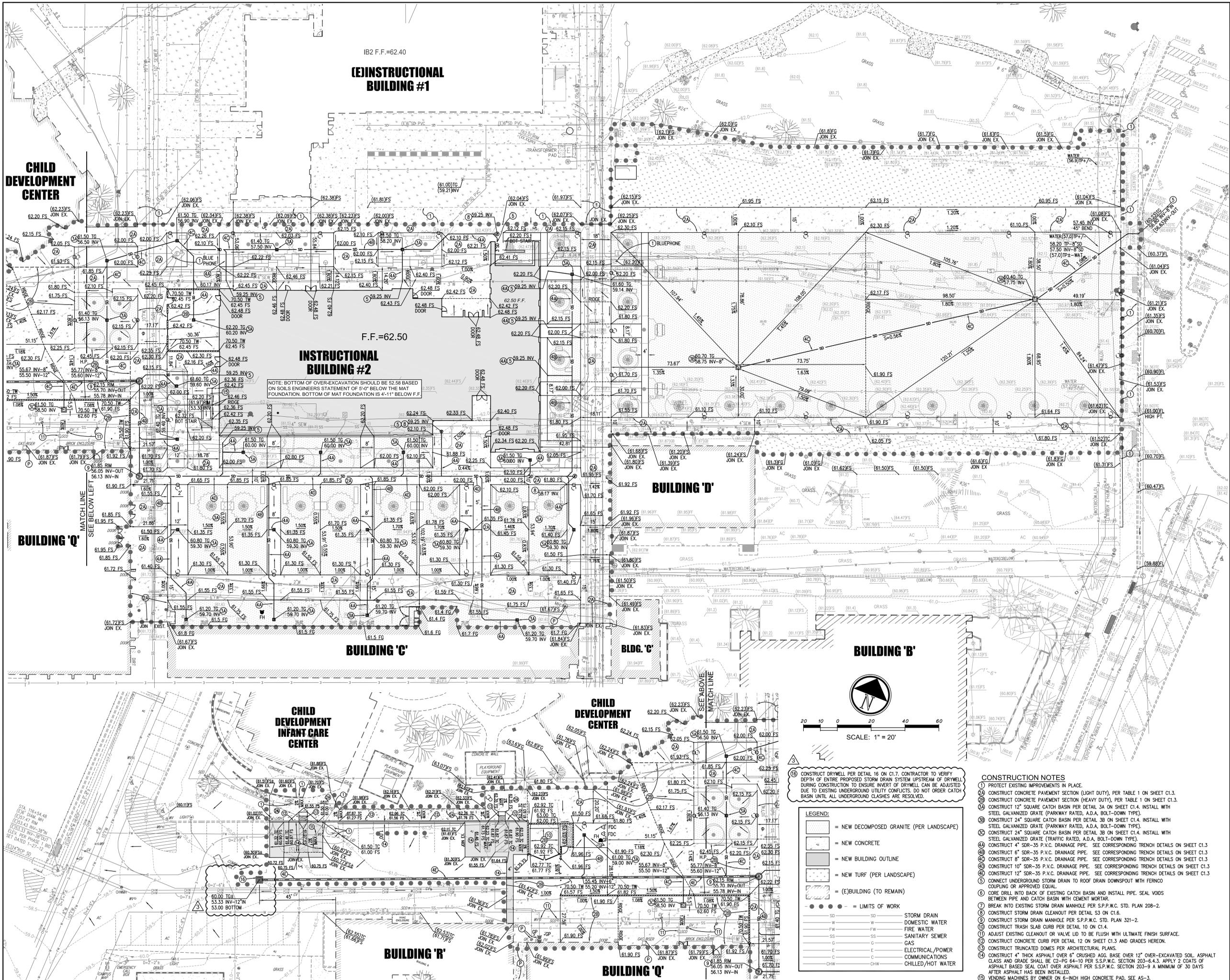
"Green" - Main central terminal location for entire site.

"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 1/8-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
092319/212227



IB2 F.F.=62.40

(E)INSTRUCTIONAL BUILDING #1

F.F.=62.50

INSTRUCTIONAL BUILDING #2

NOTE: BOTTOM OF OVER-EXCAVATION SHOULD BE 52.58 BASED ON SOILS ENGINEERS STATEMENT OF 5'-0" BELOW THE MAT FOUNDATION. BOTTOM OF MAT FOUNDATION IS 4'-11" BELOW F.F.

BUILDING 'D'

BUILDING 'C'

BLOG. 'C'

BUILDING 'B'

CHILD DEVELOPMENT INFANT CARE CENTER

CHILD DEVELOPMENT CENTER

BUILDING 'R'

BUILDING 'Q'



SCALE: 1" = 20'

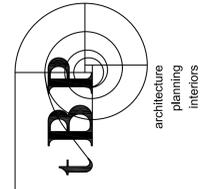
16 CONSTRUCT DRYWELL PER DETAIL 16 ON C1.7. CONTRACTOR TO VERIFY DEPTH OF ENTIRE PROPOSED STORM DRAIN SYSTEM UPSTREAM OF DRYWELL DURING CONSTRUCTION TO ENSURE INVERT OF DRYWELL CAN BE ADJUSTED DUE TO EXISTING UNDERGROUND UTILITY CONFLICTS. DO NOT ORDER CATCH BASIN UNTIL ALL UNDERGROUND CLASSES ARE RESOLVED.

LEGEND:

[Symbol]	= NEW DECOMPOSED GRANITE (PER LANDSCAPE)
[Symbol]	= NEW CONCRETE
[Symbol]	= NEW BUILDING OUTLINE
[Symbol]	= NEW TURF (PER LANDSCAPE)
[Symbol]	= (E)BUILDING (TO REMAIN)
[Symbol]	= LIMITS OF WORK
SD	STORM DRAIN
W	DOMESTIC WATER
F-W	FIRE WATER
SS	SANITARY SEWER
G	GAS
E	ELECTRICAL / POWER
C	COMMUNICATIONS
CHW	CHILLED / HOT WATER

- CONSTRUCTION NOTES**
- PROTECT EXISTING IMPROVEMENTS IN PLACE.
 - CONSTRUCT CONCRETE PAVEMENT SECTION (LIGHT DUTY), PER TABLE 1 ON SHEET C1.3.
 - CONSTRUCT CONCRETE PAVEMENT SECTION (HEAVY DUTY), PER TABLE 1 ON SHEET C1.3.
 - CONSTRUCT 12" SQUARE CATCH BASIN PER DETAIL 3A ON SHEET C1.4. INSTALL WITH STEEL GALVANIZED GRATE (PARKWAY RATED, A.D.A. BOLT-DOWN TYPE).
 - CONSTRUCT 24" SQUARE CATCH BASIN PER DETAIL 3B ON SHEET C1.4. INSTALL WITH STEEL GALVANIZED GRATE (PARKWAY RATED, A.D.A. BOLT-DOWN TYPE).
 - CONSTRUCT 4" SDR-35 P.V.C. DRAINAGE PIPE. SEE CORRESPONDING TRENCH DETAILS ON SHEET C1.3.
 - CONSTRUCT 6" SDR-35 P.V.C. DRAINAGE PIPE. SEE CORRESPONDING TRENCH DETAILS ON SHEET C1.3.
 - CONSTRUCT 8" SDR-35 P.V.C. DRAINAGE PIPE. SEE CORRESPONDING TRENCH DETAILS ON SHEET C1.3.
 - CONSTRUCT 10" SDR-35 P.V.C. DRAINAGE PIPE. SEE CORRESPONDING TRENCH DETAILS ON SHEET C1.3.
 - CONSTRUCT 12" SDR-35 P.V.C. DRAINAGE PIPE. SEE CORRESPONDING TRENCH DETAILS ON SHEET C1.3.
 - CONNECT UNDERGROUND STORM DRAIN TO ROOF DRAIN DOWNSPOUT WITH FERNCO COUPLING OR APPROVED EQUAL.
 - CORR. DIRT INTO BACK OF EXISTING CATCH BASIN AND INSTALL PIPE. SEAL VOIDS BETWEEN PIPE AND CATCH BASIN WITH CEMENT MORTAR.
 - BREAK INTO EXISTING STORM DRAIN MANHOLE PER S.P.P.W.C. STD. PLAN 208-2.
 - CONSTRUCT STORM DRAIN CLEANOUT PER DETAIL S3 ON C1.6.
 - CONSTRUCT STORM DRAIN MANHOLE PER S.P.P.W.C. STD. PLAN 321-2.
 - CONSTRUCT TRASH SLAB CURB PER DETAIL 10 ON C1.4.
 - ADJUST EXISTING CLEANOUT OR VALVE LID TO BE FLUSH WITH ULTIMATE FINISH SURFACE.
 - CONSTRUCT CONCRETE CURB PER DETAIL 12 ON SHEET C1.3 AND GRADES HEREON.
 - CONSTRUCT TRUNCATED DOMES PER ARCHITECTURAL PLANS.
 - CONSTRUCT 4" THICK ASPHALT OVER 6" CRUSHED AGG. BASE OVER 12" OVER-EXCAVATED SOIL. ASPHALT CLASS AND GRADE SHALL BE C2-PG 64-10 PER S.P.P.W.C. SECTION 203-6.4.3. APPLY 2 COATS OF ASPHALT BASED SEAL COAT OVER ASPHALT PER S.P.P.W.C. SECTION 203-9 A MINIMUM OF 30 DAYS AFTER ASPHALT HAS BEEN INSTALLED.
 - WELDING MACHINES BY OWNER ON 6-INCH HIGH CONCRETE PAD, SEE AS-3.

DIVISION OF STATE ARCHITECT
355 South Grand Avenue, Suite 2100
Los Angeles, California, 90012
ph: (213) 897-3995 Fax: (213) 897-3156
agency



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) 252-1688



Alan Wing-Chi Lee
ALAN WING-CHI LEE
R.C.E. 34971
EXP. 08-30-19
consultant

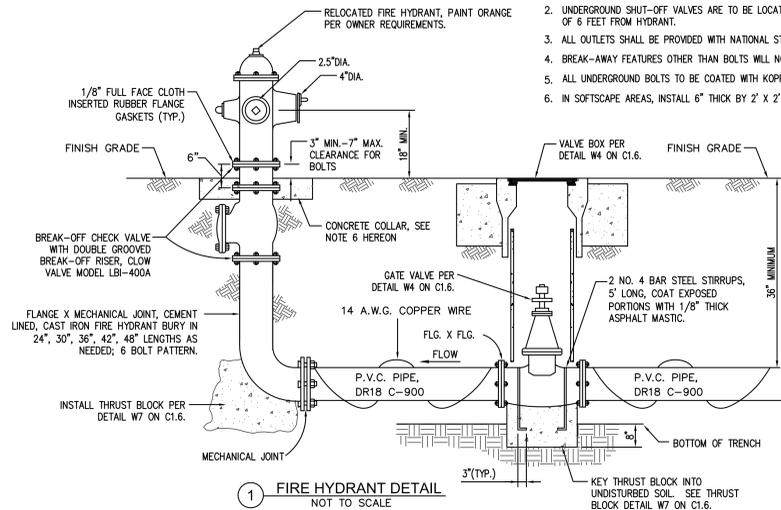
COMPTON COLLEGE
INSTRUCTIONAL BUILDING No. 2
COMPTON COMMUNITY COLLEGE DISTRICT
1111 E. ARTESIA BLVD. COMPTON, CA

owner	
TBP project number :	20998.00
file name:	
drawn by:	checked by:
date:	04/08/2019
Rev:	date: description:
1	9/4/19 ADDENDUM 2
2	9/24/19 ADDENDUM 3
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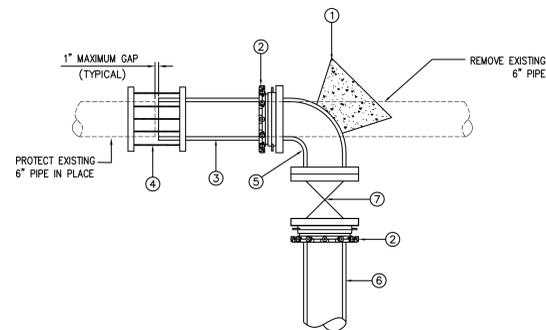
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FIRE HYDRANT GENERAL NOTES:

1. FIRE HYDRANT SUPPLY PIPING SHALL BE A MINIMUM OF SIX INCHES IN DIAMETER. THE LOWEST OPERATING NUT SHALL BE A MINIMUM OF 18" ABOVE GRADE AND THE HYDRANT FLANGE SHALL BE A MINIMUM OF 2" ABOVE GRADE.
2. UNDERGROUND SHUT-OFF VALVES ARE TO BE LOCATED A MINIMUM DISTANCE OF 6 FEET FROM HYDRANT.
3. ALL OUTLETS SHALL BE PROVIDED WITH NATIONAL STANDARD THREADS (NTS).
4. BREAK-AWAY FEATURES OTHER THAN BOLTS WILL NOT BE ACCEPTED.
5. ALL UNDERGROUND BOLTS TO BE COATED WITH KOPPERS BITUMASTIC #50 OR EQUAL.
6. IN SOFTSCAPE AREAS, INSTALL 6" THICK BY 2' X 2' CONCRETE COLLAR.



1 FIRE HYDRANT DETAIL
NOT TO SCALE



6 CUT-IN DETAIL
NOT TO SCALE

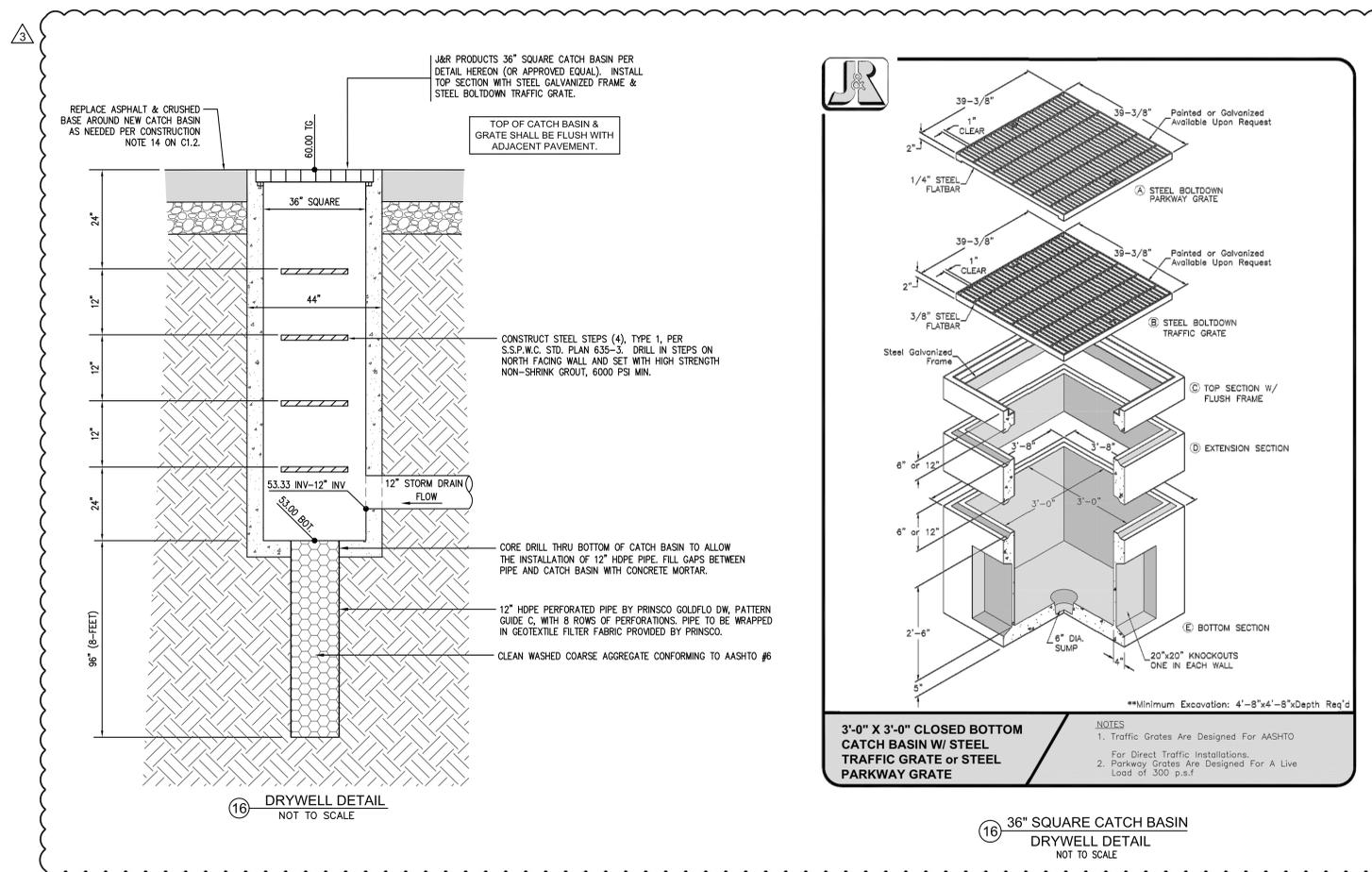
CUT-IN TEE CONSTRUCTION NOTES:

- * ALL BOLTS SHALL BE STAINLESS STEEL TYPE 316.
- 1 CONSTRUCT CONCRETE THRUST BLOCK PER DETAIL W7 ON C1.6.
- 2 INSTALL "EBAA IRON" 6" RESTRAINED FLANGE ADAPTER, SERIES 2106.
- 3 INSTALL 6" P.V.C. PRESSURE PIPE, A.W.W.A. C900, DR 14, MINIMUM LENGTH 18"
- 4 INSTALL 6" "SMITH-BLAIR" MODEL 411 STEEL COUPLING WITH 10" SLEEVE, OR EQUAL.
- 5 INSTALL 6" X 6" D.I. 90° BEND, FLGD.
- 6 INSTALL 6" AWWA C-900, DR 18, PVC PIPE.
- 7 INSTALL 6" EPOXY COATED GATE VALVE PER DETAIL W4 ON C1.6.

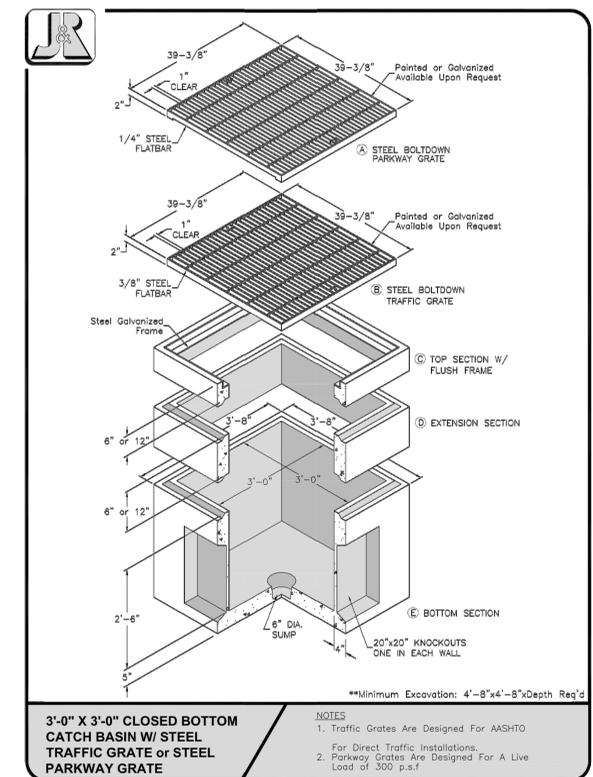
NOTE: MECHANICAL RESTRAINT DEVICES & COUPLINGS SHALL BE WRAPPED WITH 3 LAYERS OF 8-MIL POLYETHYLENE AFTER ASSEMBLY.

NOTES FOR UNDERGROUND PIPING FOR PRIVATE HYDRANTS & SPRINKLERS

1. PRIOR TO INSTALLATION, ALL PLANS AND SPECIFICATIONS SHALL BE APPROVED BY D.S.A. REFER TO DSA #R A-25 FOR DESIGN, INSTALLATION AND MAINTENANCE GENERAL REQUIREMENTS.
2. INSPECTIONS ARE REQUIRED: 1) PRIOR TO POURING THRUST BLOCKS, 2) FOR HYDROSTATIC TESTING, AND 3) FOR FLUSH.
3. INSTALLATION, INSPECTION, AND TESTING SHALL CONFORM TO 2016 EDITIONS CFC, NFPA 13 AND NFPA 24.
4. PRIVATE FIRE HYDRANT SHALL BE APPROVED MET BARREL STYLE WITH A MINIMUM OF 2 1/2" AND ONE 4" OUTLET. THE 4" OUTLET SHALL FACE THE FIRE DEPARTMENT ACCESS ROAD. ALL OUTLETS SHALL BE PROVIDED WITH NATIONAL STANDARD THREADS (NST), NFPA 24, 7.1.1.2.
5. FIRE HYDRANT SUPPLY PIPING SHALL BE A MINIMUM OF SIX INCHES IN DIAMETER. THE CENTER OF THE HOSE OUTLET SHALL BE NOT LESS THAN 18" ABOVE FINAL GRADE OR, WHERE LOCATED IN A HOUSE, 12" ABOVE THE FLOOR. NFPA 24, 7.1.1 & 7.3.3.
6. FIRE HYDRANTS SHALL BE A MINIMUM OF 40 FEET FROM ALL STRUCTURES. NFPA 24, 7.2.3.
7. A KEYS GATE VALVE SHALL BE PROVIDED FOR EACH HYDRANT IN AN ACCESSIBLE LOCATION. VALVES SHALL NOT BE LOCATED IN PARKING STALLS. NFPA 24, 7.1.1.1.
8. ALL PIPING SHALL BE LISTED FOR USE IN FIRE PROTECTION SERVICE AND COMPLY WITH AWWA STANDARDS (CLASS 150 MINIMUM) CLASS 200 PIPE SHALL BE USED WHERE THE PRESSURE MAY EXCEED 150 PSI. NFPA 24, 10.1.1 & 5.
9. ALL BOLTED JOINTS SHALL BE CLEANED AND THOROUGHLY COATED WITH ASPHALT OR OTHER CORROSION RETARDING MATERIAL AFTER INSTALLATION. NFPA 24, 10.3.6.2.
10. BACKFILL SHALL BE WELL TAMPED LAYERS TO CONSIST OF 6" MINIMUM BED OF CLEAN FILL SAND OR PEA GRAVEL BELOW AND 12" ABOVE THE PIPE (TOTAL 18" MINIMUM). NFPA 24, 10.3.1.
11. FITTINGS SHALL BE OF AN APPROVED TYPE. NFPA 24, 10.2.1.
12. A MINIMUM OF 30" OF COVER, FROM FINISH GRADE TO THE TOP OF THE PIPE, SHALL BE PROVIDED. WHEN SURFACE LOADS ARE EXPECTED, A MINIMUM OF 36" COVER SHALL PROVIDED. NFPA 24, 10.4.4.
13. THRUST BLOCKS, OR OTHER APPROVED METHOD OF THRUST RESTRAINT, SHALL BE PROVIDED WHEREVER PIPE CHANGES DIRECTION. BACK-FILL BETWEEN THE JOINTS TO PREVENT MOVEMENT OF THE PIPE. PROVIDE DETAILS AND CALCULATIONS FOR SIZING THRUST BLOCKS BASE ON ACTUAL SOIL CONDITIONS. NFPA 24, 10.8.
14. A HYDROSTATIC TEST (200 PSI FOR TWO HOURS OR 50 PSI OVER MAXIMUM STATIC PRESSURE, WHICHEVER IS GREATER) SHALL BE PERFORMED. NFPA 24, 10.10.2.2.1.
15. THE SYSTEM SHALL BE THOROUGHLY FLUSHED BEFORE CONNECTION IS MADE TO OVERHEAD PIPING. FLOW SHALL BE THROUGH A MINIMUM OF 4" HOSE OF PIPE. NFPA 24, 10.10.2.1.
16. ALL CONTROL VALVES SHALL BE LOCKED IN THE OPEN POSITION. VALVES SHALL BE MONITORED IF THEY SERVE 20 OR MORE SPRINKLER HEADS. CBC/CFC 903.4.
17. ALL CONTROL VALVES SHALL BE LISTED INDICATING TYPE UNLESS A NON-INDICATING VALVE, SUCH AS AN UNDERGROUND GATE VALVE WITH APPROVED ROADWAY BOX COMPLETE WITH T-WRENCH, IS ACCEPTABLE TO AUTHORITY HAVING JURISDICTION (AHJ). NFPA 24, 6.1.1.
18. POST INDICATING VALVES (PIV) SHALL BE TESTED TO INSURE THAT THE "TARGETS" (OPEN, CLOSED) ARE CLEARLY IDENTIFIED WHEN VALVE IS OPENED AND CLOSED. NFPA 24, 10.10.1 & 14.1.
19. TEST SHALL BE MADE BY THE INSTALLING CONTRACTOR IN THE PRESENCE OF THE (AHJ). PROVIDE A COMPLETED CONTRACTOR'S MATERIAL AND TEST CERTIFICATE FOR UNDERGROUND PIPING TO DSA. NFPA 24, 10.10.1 & 14.1, CFC 901.5 & 6.



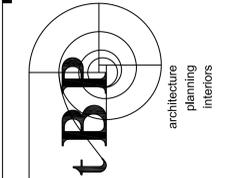
16 DRYWELL DETAIL
NOT TO SCALE



16 36\"/>

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DIVISION OF STATE ARCHITECT
355 South Grand Avenue, Suite 2100
Los Angeles, California. 90012
ph: (213) 897-3995 Fax: (213) 897-3155
agency



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) 252-1688



Alan Wing-Chi Lee
ALAN WING-CHI LEE
R.C.E. 34971
EXP. 09-30-19
consultant

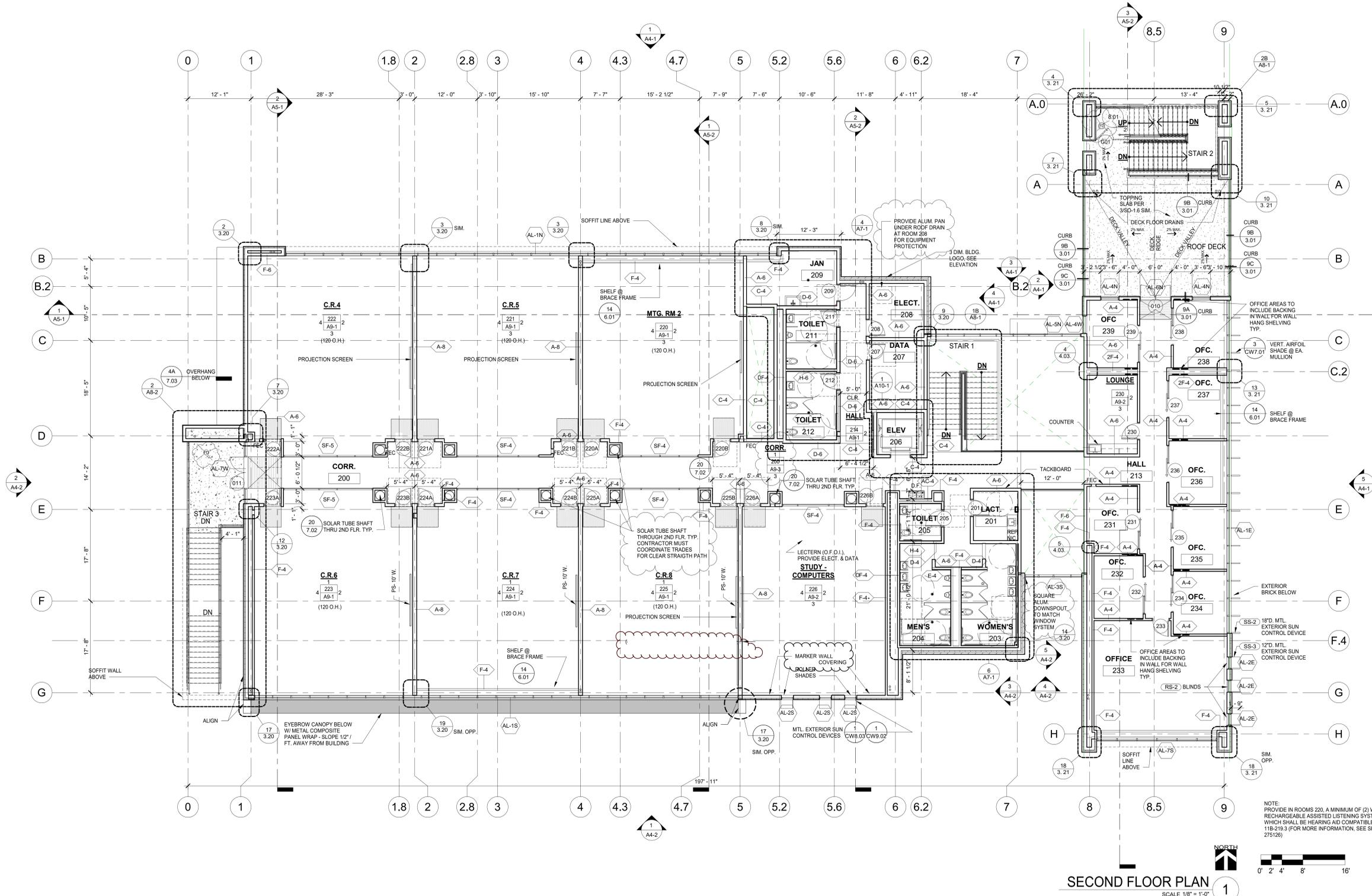
COMPTON COLLEGE
INSTRUCTIONAL BUILDING No. 2
COMPTON COMMUNITY COLLEGE DISTRICT
1111 E. ARTESIA BLVD. COMPTON, CA.

owner
TBP project number : 20998.00
file name:
drawn by: checked by:
date: 04/08/2019
Rev: date: description:
9/24/19 ADDENDUM 3

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drawing title:
UTILITY DETAILS

drawing no.:
C1.7
drawing of



SECOND FLOOR PLAN
SCALE 1/8" = 1'-0"

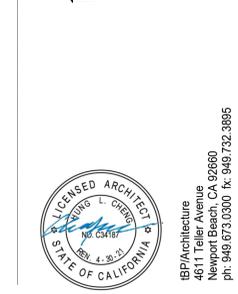
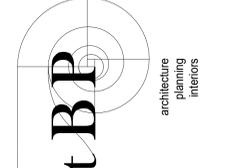
NOTE:
PROVIDE IN ROOMS 220, A MINIMUM OF (2) WIRELESS RECHARGEABLE ASSISTED LISTENING SYSTEM DEVICES WHICH SHALL BE HEARING AID COMPATIBLE PER CFC 119-219.3 (FOR MORE INFORMATION, SEE SPEC SECTION 275126)

LEGEND

NOTE: REFER TO SHEET T-2 FOR ADDITIONAL SYMBOLS

Room name	ROOM SYMBOL	MB - 8" W.	MARKER BOARD (MB) OR TACKBOARD (TB) AND SIZE
ROOM NUMBER	101		
INTERIOR ELEVATION NUMBER	A10-X-2	PS - 6" W.	PROJECTION SCREEN PER 10/5.02
SHEET NUMBER	3	(GEO-1)	GEO TILE AT INTERIOR ENTRY DOORS AS INDICATED
DOOR TAG, SEE SHEET 8.01	(13)	(SST-3)	RECESSED STAINLESS STL. ENTRANCE FLOOR GRILLE 16/8.11 17/8.11
WINDOW TAG, SEE SHEETS 8.50, 8.51 AND CW SHEETS	(11)		
WALL TYPE, SEE SHEET 4.01	(1A)		
MATERIAL SYMBOL, SEE FINISH & COLOR SCHEDULES, SHEET 9.01	(XXX-X)		
FIRE EXTINGUISHER CABINET LOCATION, TRAVEL DIST. FROM ANYWHERE IN BLDG. TO A FIRE EXTINGUISHER LOCATION SHALL NOT EXCEED 75' PER CFC SECT. 906, TABLE 2	F.E.C.	(12)	CONTRACTOR MUST FURNISH AND INSTALL WALL MOUNTED KWIKBOOST 8-BAY PHONE CHARGING LOCKER, EQUIPMENT 24"X 48" X 5" DEEP W/ 3 CABLE PER BAY AND EXTRA SECURITY LOCK-KEY SEE INTERIOR ELEVATIONS FOR ADDITIONAL INFORMATION.
FLOOR DRAIN, DECK DRAIN	F.D. D.D.	(8)	
1 HR RATED WALL		(9)	

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Los Angeles, CA 90012
ph: (213) 897-3995 fx: (213) 897-3159
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4611 Teller Avenue
Newport Beach, CA 92660
ph: 949.673.0300 fx: 949.732.3895
architect

consultant

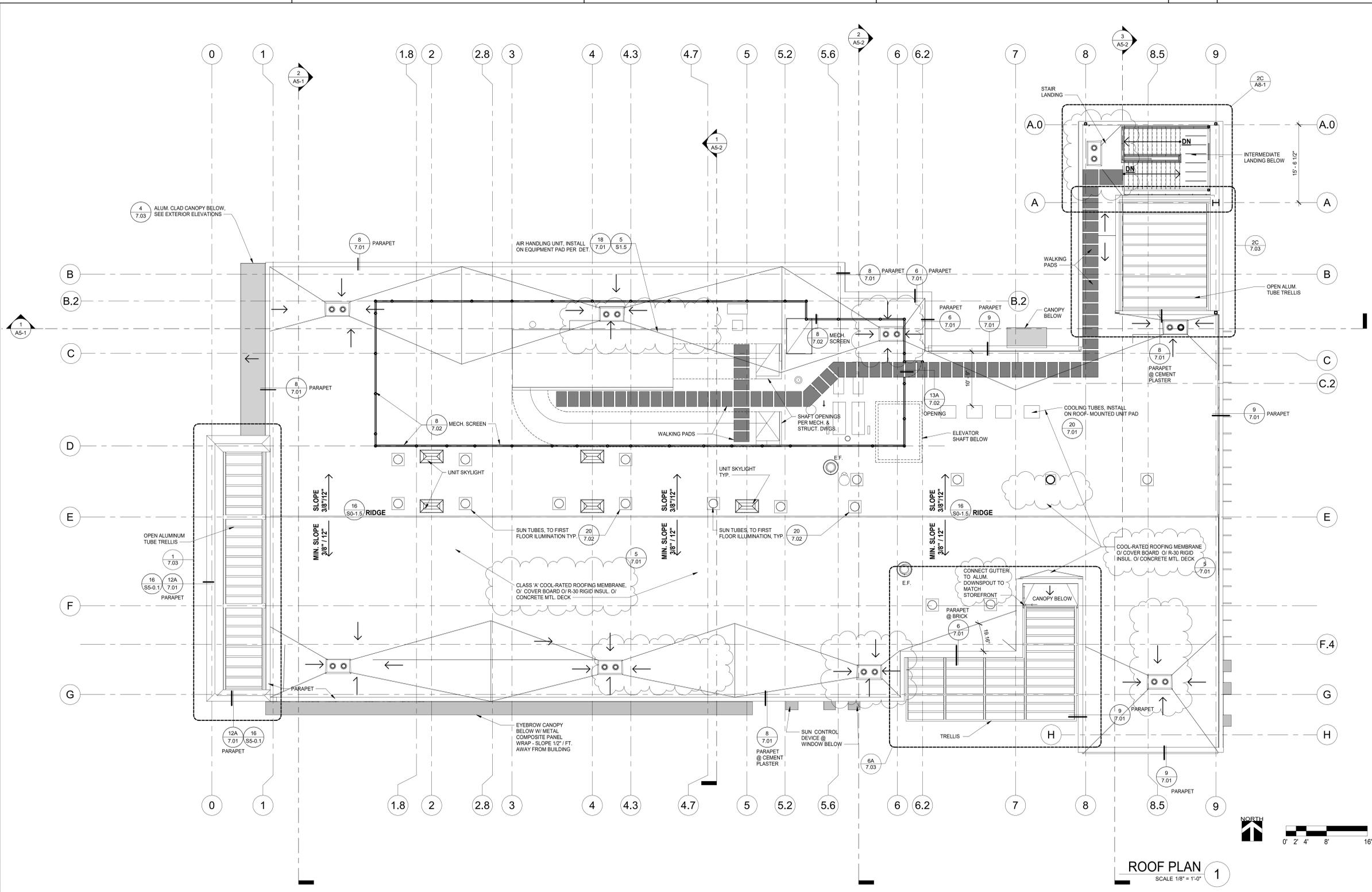
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2/9/2019 Addendum 3

drawing title:
FLOOR PLAN - SECOND FLOOR

drawing no.:
A1-2
drawing of

1/20/2019 2:20:43 PM



ROOF PLAN 1
SCALE 1/8" = 1'-0"

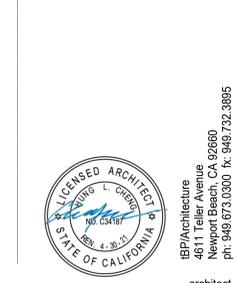
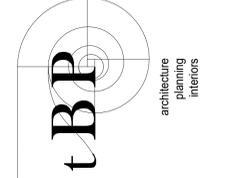


LEGEND

NOTE: ALL ROOFING SHALL BE CLASS 'A'

- O.D. OVERFLOW DRAIN
- R.D. ROOF DRAIN
- T.O.P. TOP OF PARAPET
- T.O.S. TOP OF STEEL UNDERSIDE OF DECK (U.N.O.)
- F.D. FLOOR DRAIN
- R.D. ROOF AND OVERFLOW DRAIN
- CRICKET
- ROOF TOP DUCTS, SEE MECH. DWGS.
- DIRECTION OF ROOF SLOPE
- UNIT SKYLIGHT LOW-E SKYLIGHT, PER DESIGN: VELUX FCM CURB-MOUNT FIXED 2'-0" X 4'-0" PER
- EXHAUST FAN PER MECHANICAL DWGS.
- SUN TUBES
- WALKING PAD

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Newport Beach, CA 92660
ph: 949.673.0300 fx: 949.732.3895
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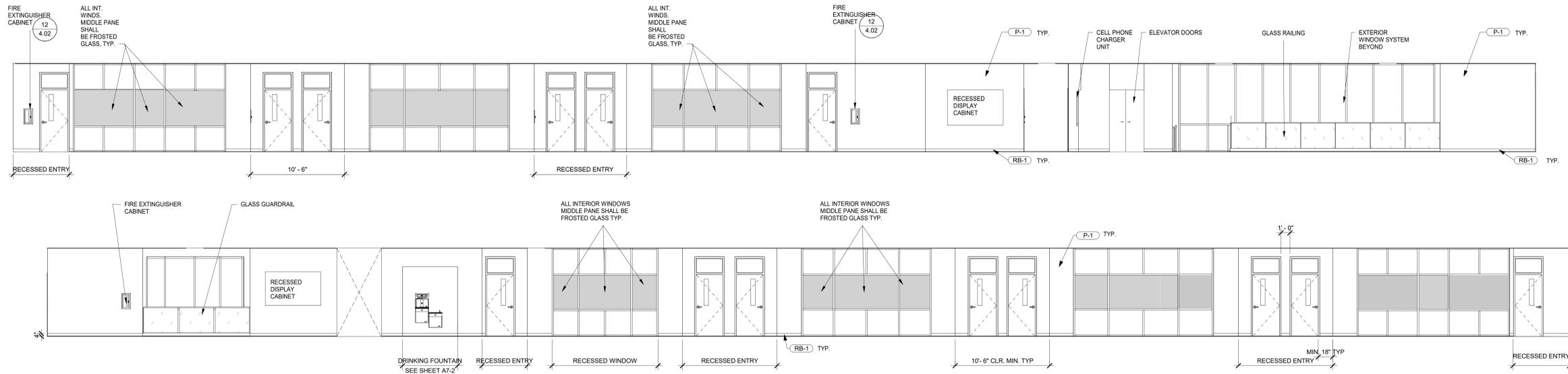
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drawing title:
ROOF PLAN

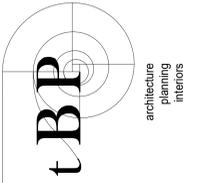
drawing no.:
A3-1
drawing of



CORRIDOR
SCALE: 3/16" = 1'-0"

200

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4811 Teller Avenue
Newport Beach, CA 92660
ph: 949.673.0300 fx: 949.732.3865
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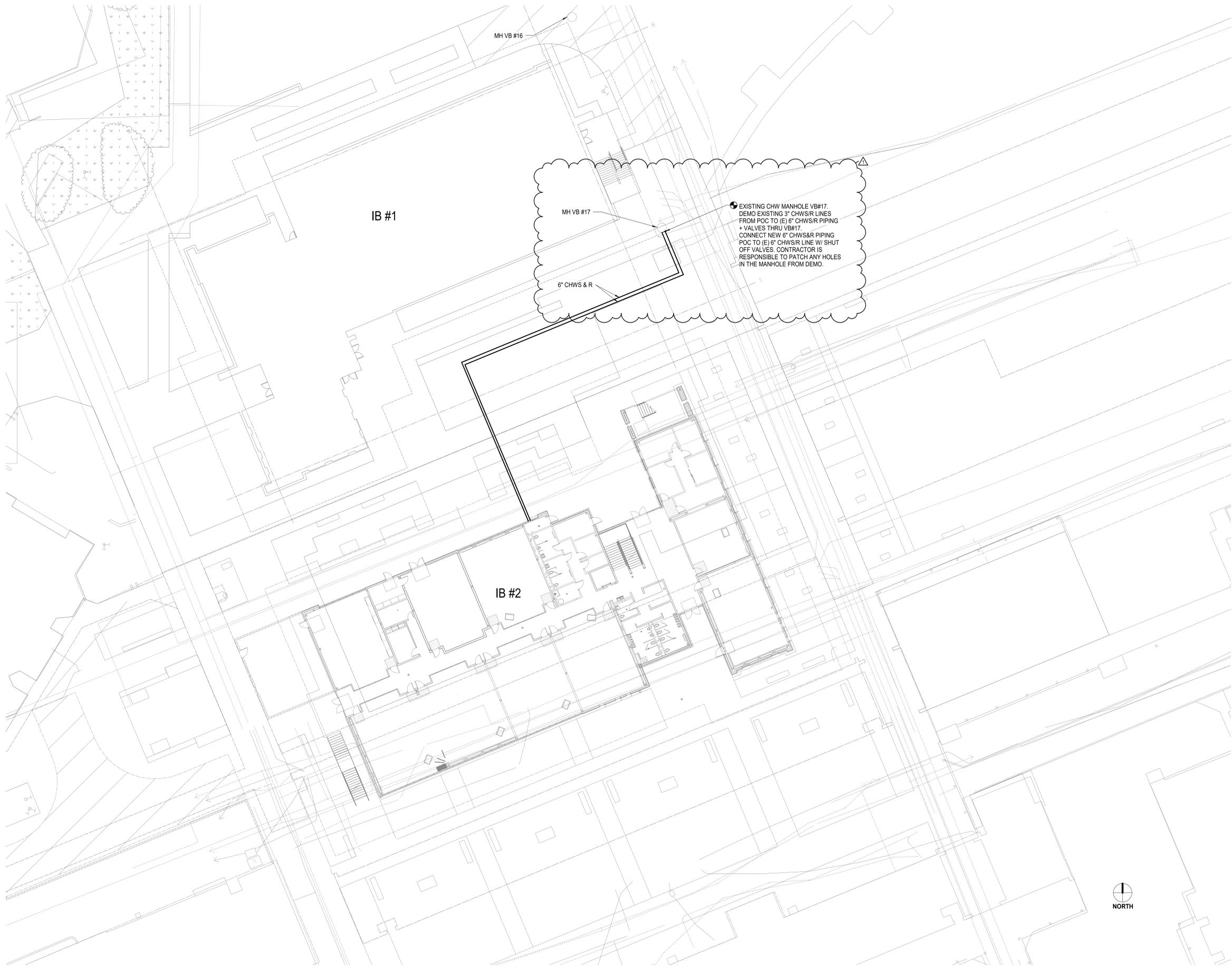
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drawn by:	checked by:
date:	04/08/2019
rev:	date: description:
2	9/20/2019 Addendum 3

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drawing title:
INTERIOR ELEVATIONS

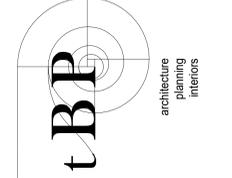
drawing no.:
A9-3
drawing of

9/24/2019 4:50:15 PM



● EXISTING CHW MANHOLE VB#17.
 DEMO EXISTING 3" CHWS/R LINES
 FROM POC TO (E) 6" CHWS/R PIPING
 + VALVES THRU VB#17
 ● CONNECT NEW 6" CHWS/R PIPING
 POC TO (E) 6" CHWS/R LINE W/ SHUT
 OFF VALVES. CONTRACTOR IS
 RESPONSIBLE TO PATCH ANY HOLES
 IN THE MANHOLE FROM DEMO.

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 Los Angeles, CA 90012
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 agency



tBP Architecture
 4611 Teller Avenue
 Newport Beach, CA 92660
 ph: 949.673.0300 fx: 949.732.3895
 architect



DATE SIGNED: 04/05/19 consultant

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tBP project number:	20998.00
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rev:	date: description:
▲	9/20/2019 Addendum 3

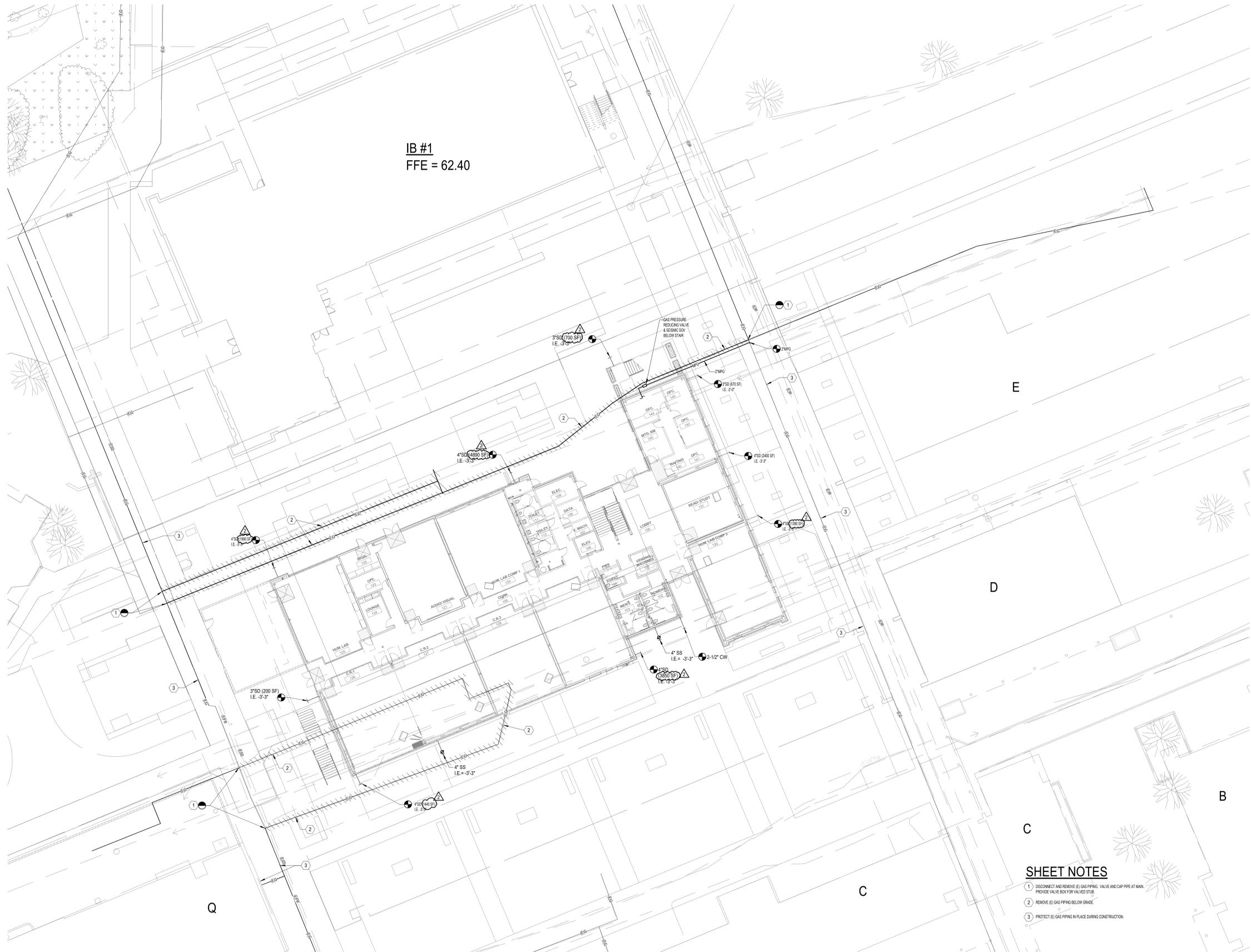
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drawing title:
MECHANICAL SITE PLAN

drawing no.
M0-6
 drawing of

MECHANICAL SITE PLAN
 SCALE: 1/16" = 1'-0" **1**

1_04/20/2019 11:01:26 AM



IB #1
FFE = 62.40

SHEET NOTES

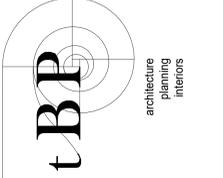
- 1 DISCONNECT AND REMOVE EX GAS PIPING. VALVE AND CAP PIPE AT MAIN. PROVIDE VALVE BOX FOR VALVED STOP.
- 2 REMOVE EX GAS PIPING BELOW GRADE.
- 3 PROTECT EX GAS PIPING IN PLACE DURING CONSTRUCTION.

PLUMBING SITE PLAN
 SCALE 1/16" = 1'-0"



1

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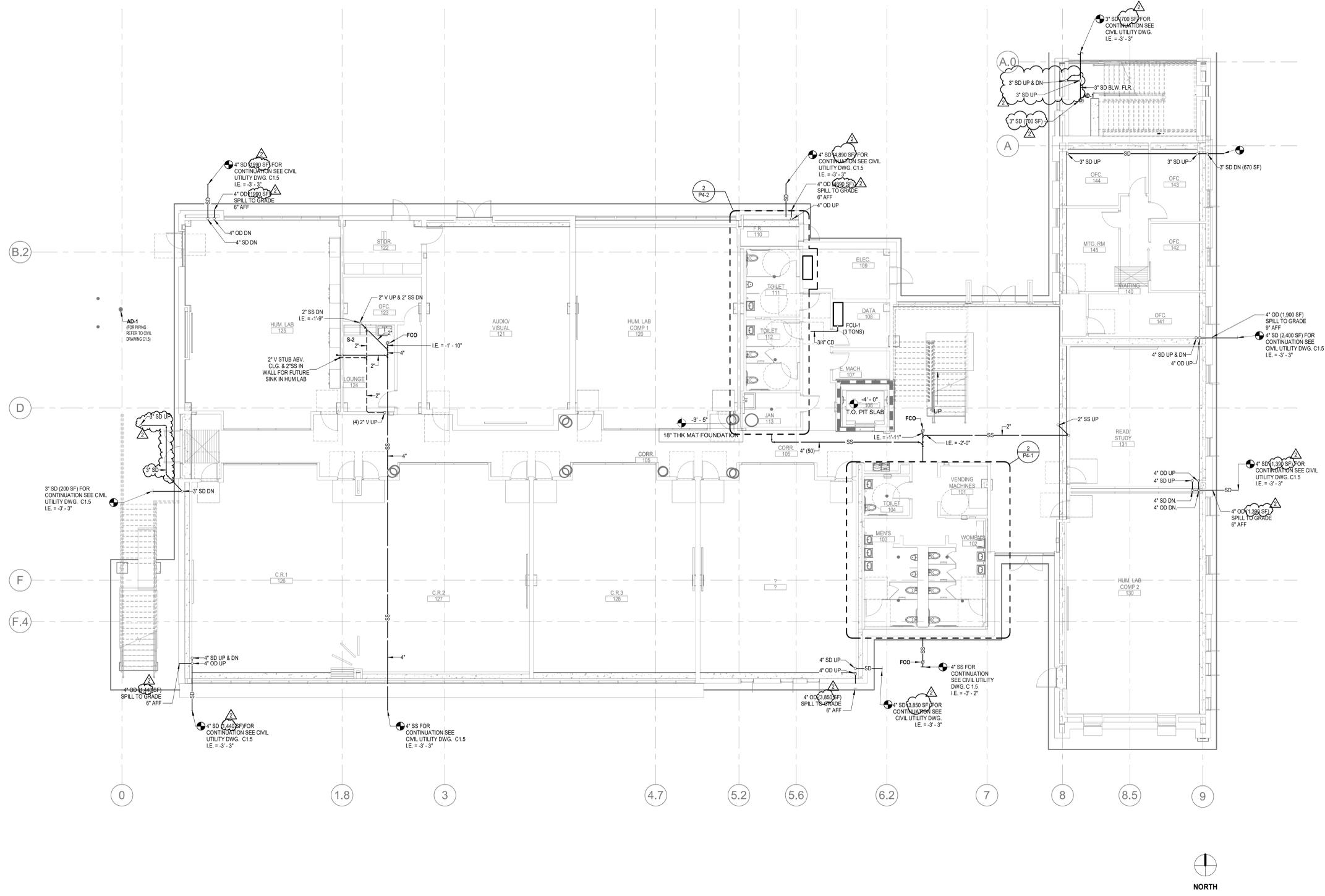
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drawing title:
PLUMBING SITE PLAN

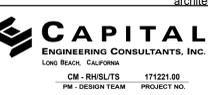
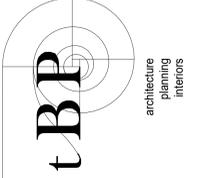
drawing no.:
P0-3
 drawing of

1 8/24/2019 8:49:30 AM



PLUMBING FIRST FLOOR PLAN - GRAVITY 1
SCALE 1/8" = 1'-0"

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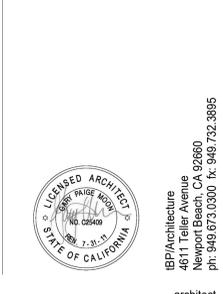
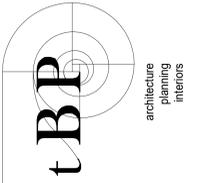
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PLUMBING FIRST FLOOR PLAN - GRAVITY

drawing no.:
P1-1
drawing of

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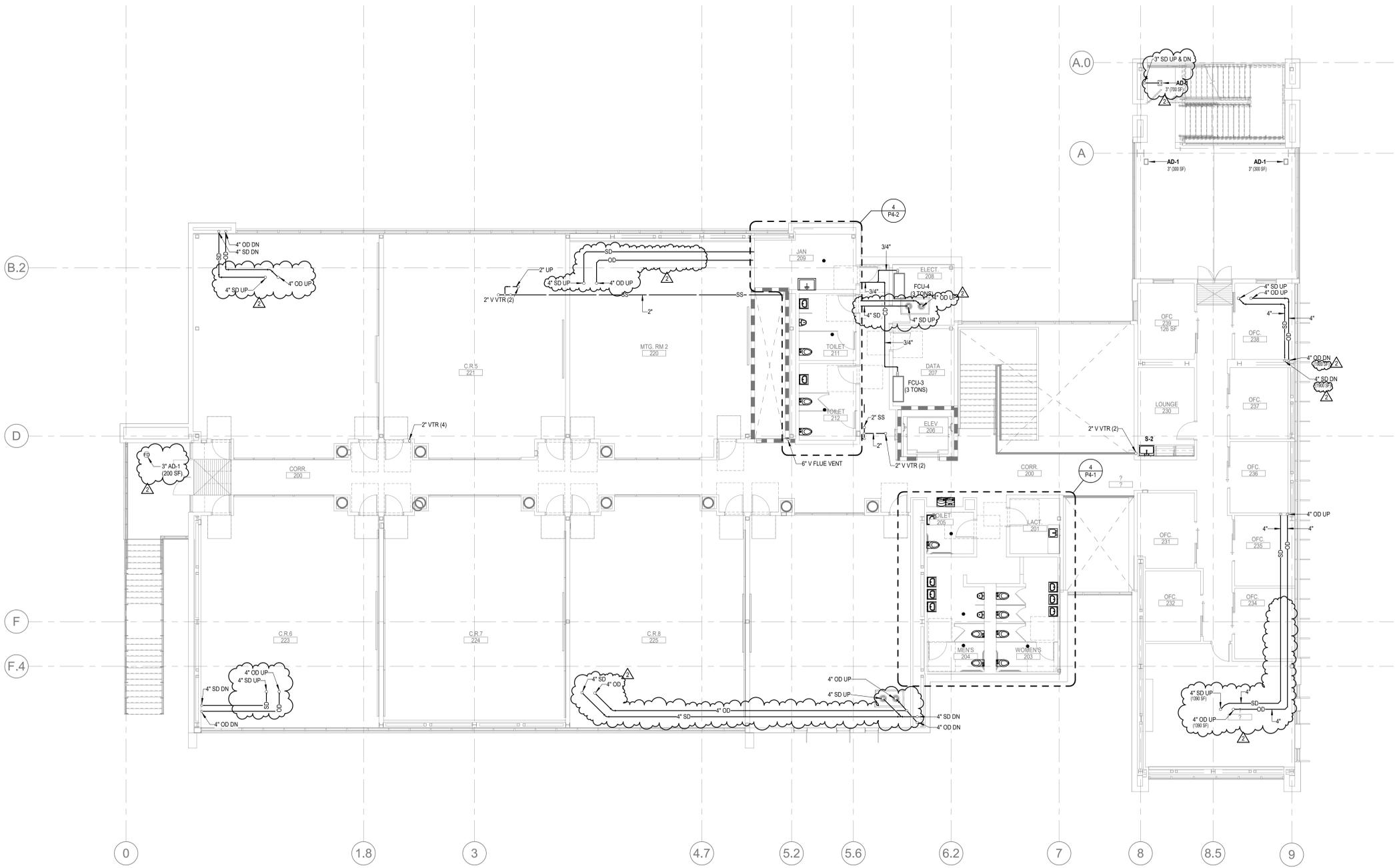


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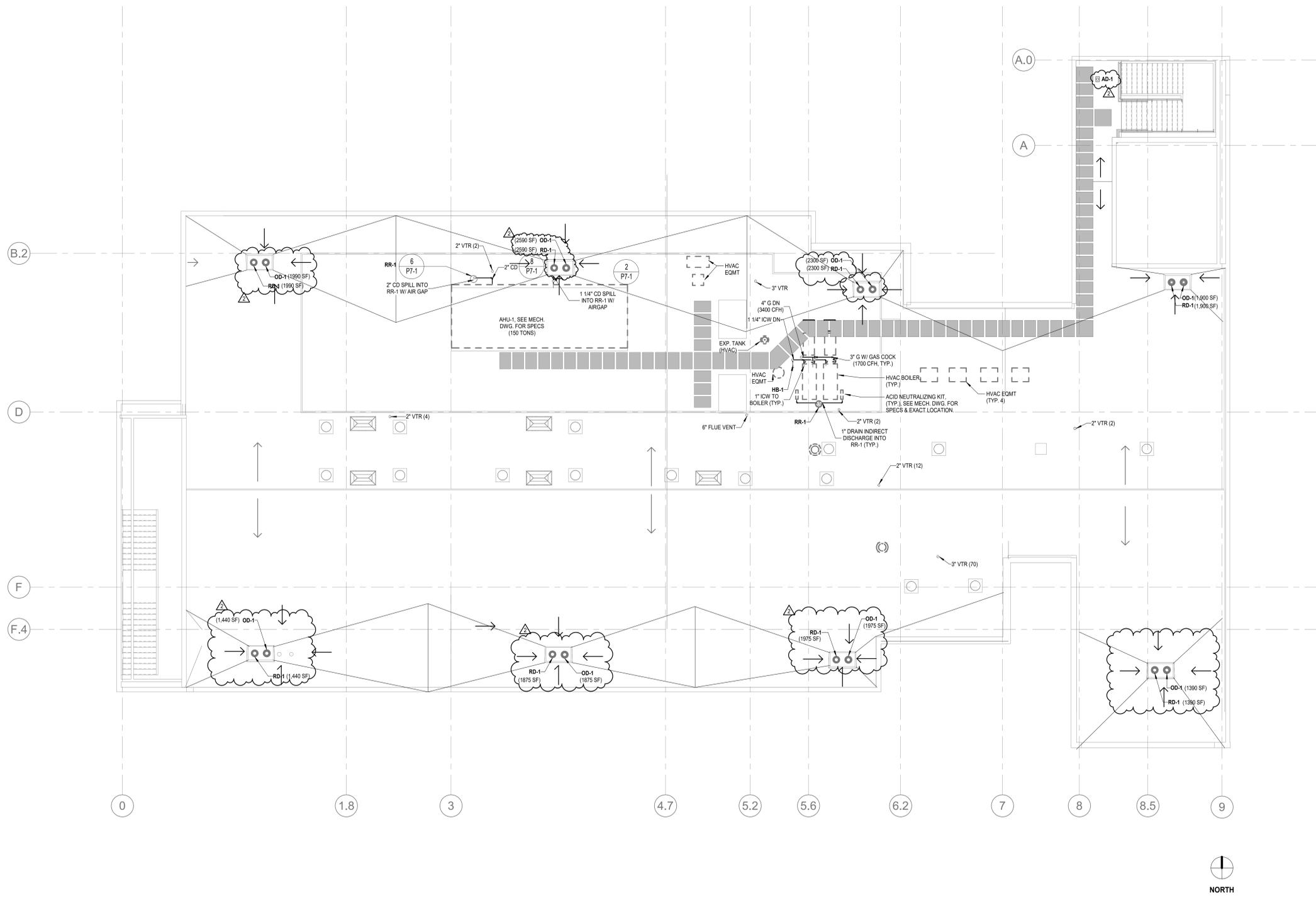
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drawing title:
PLUMBING SECOND FLOOR PLAN - GRAVITY
 drawing no.:
P2-1
 drawing of



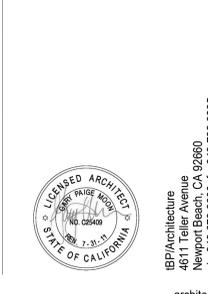
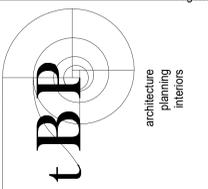
PLUMBING SECOND FLOOR PLAN - GRAVITY
 SCALE 1/8" = 1'-0" 1



PLUMBING ROOF PLAN
SCALE 1/8" = 1'-0" **1**



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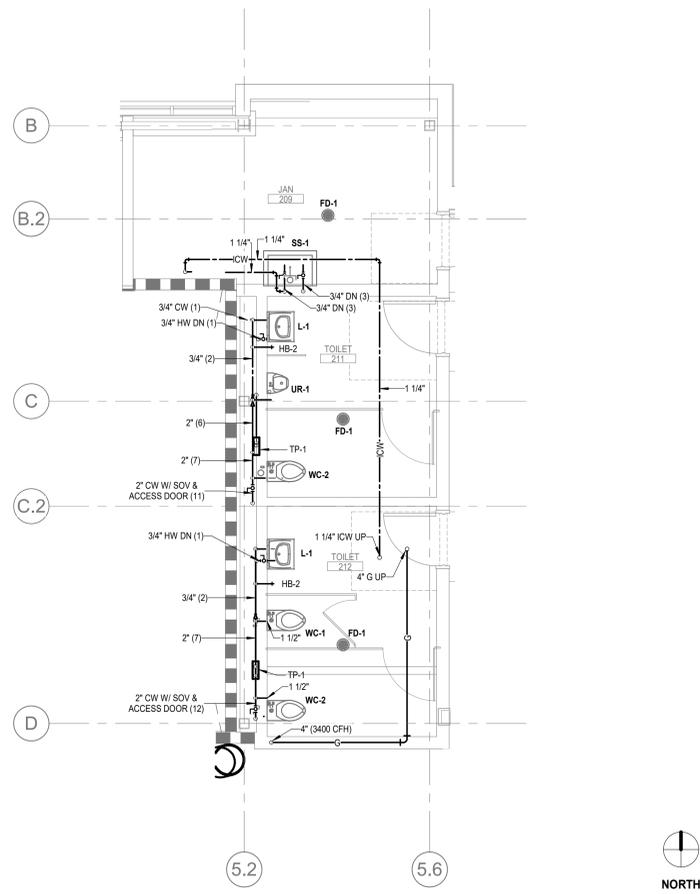
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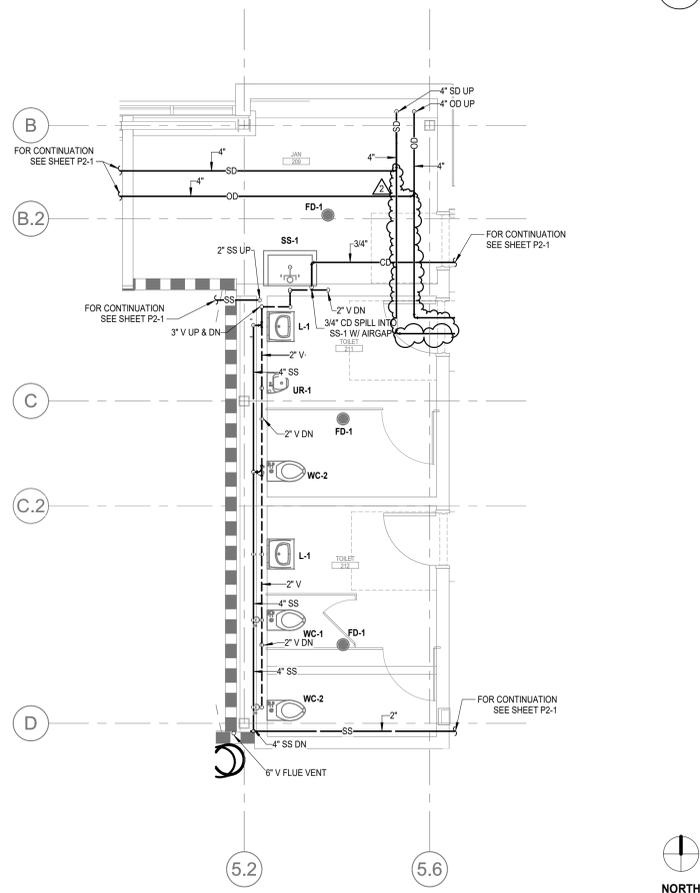
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drawing no.:
P3-1
drawing of

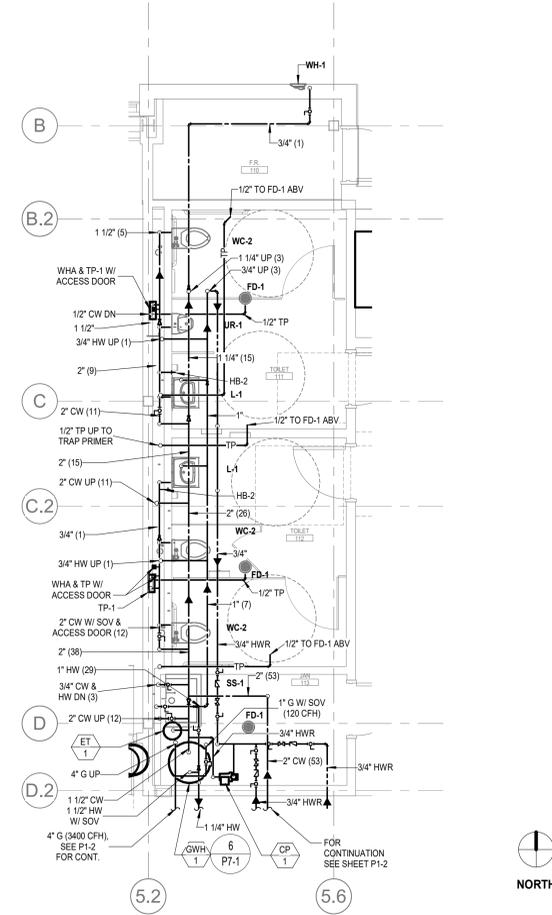
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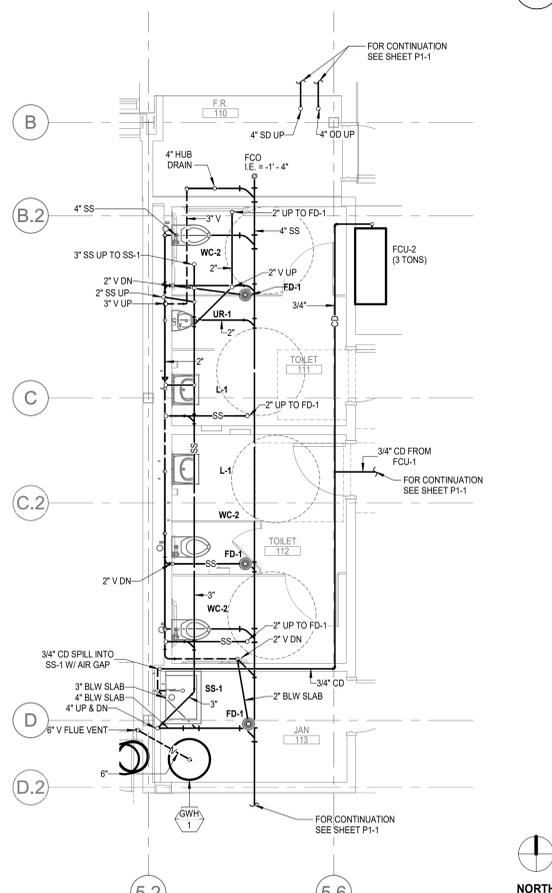
ENLARGED SECOND FLOOR PLAN - RM 209, 211 & 212 - PRESSURE 3
SCALE 1/4" = 1'-0"



ENLARGED SECOND FLOOR PLAN - RM 209, 211 & 212 - GRAVITY 4
SCALE 1/4" = 1'-0"

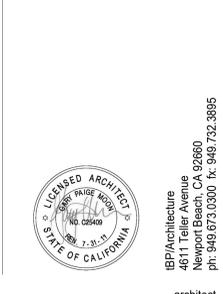
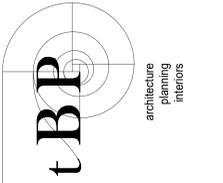


ENLARGED FIRST FLOOR PLAN - RM 111 & 112 - PRESSURE 1
SCALE 1/4" = 1'-0"



ENLARGED FIRST FLOOR PLAN - ROOM 111 & 112 GRAVITY 2
SCALE 1/4" = 1'-0"

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PLUMBING ENLARGED PLANS

drawing no.:
P4-2
drawing of

8/23/2019 5:23:58 PM

GENERAL NOTES

- 1. THESE DRAWINGS AND SPECIFICATIONS ARE INTENDED TO COVER A COMPLETE INSTALLATION OF SYSTEMS... 2. THESE PLANS, SPECIFICATIONS, AND ALL MATERIALS SHALL BE IN FULL ACCORDANCE WITH ALL CITY AND INDUSTRY REQUIREMENTS... 14. IN THE EVENT CHANGES IN THE INDICATED LOCATIONS OR ARRANGEMENTS ARE NECESSARY... 15. THE DRAWINGS INDICATE APPROXIMATE LOCATIONS OF EXISTING CONDUITS... 16. PERFORM CUTTING AND PATCHING ON THE CONSTRUCTION WORK WHICH MAY BE REQUIRED FOR THE PROPER INSTALLATION OF THE ELECTRICAL WORK... 17. PROVIDE ALL EQUIPMENT WITH ENCLOSURES LISTED OR LABELED FOR USE AND LOCATION WHERE SUCH EQUIPMENT IS INSTALLED... 18. PROVIDE UL LISTED FIRE STOP FOR ALL PENETRATIONS THROUGH FIRE RATED FLOORS, WALLS AND CEILINGS... 19. PROVIDE COORDINATED SHOP DRAWINGS, INDICATING DIMENSIONS, LOCATIONS AND SIZES OF ALL CORE DRILLS FOR REVIEW AND APPROVAL... 20. GROUNDING SHALL BE EXECUTED IN ACCORDANCE WITH ALL APPLICABLE CODES AND REGULATIONS... 21. PROVIDE GROUND WIRE IN EACH CONDUIT CONTAINING CIRCUITS FEEDING RECEPTACLES... 22. WHERE CIRCUIT CHANGES OR ADDITIONS OCCUR IN PANELBOARDS UPDATE PANEL DIRECTORY CARDS WITH NEW TYPEDWRITTEN CARDS INDICATING DESCRIPTION OF ALL CIRCUITS... 23. PROVIDE HANDLE TIES AT CIRCUIT BREAKERS TO SIMULTANEOUSLY DISCONNECT ALL UNGROUNDED CONDUCTORS OF MULTI-WIRE BRANCH CIRCUITS WITH A SHARED NEUTRAL... 24. UNLESS NOTED OTHERWISE ALL 120 VOLT HOMERUNS OVER 100 FEET SHALL BE #10 AWG MINIMUM... 25. UNLESS NOTED OTHERWISE ALL 277 VOLT HOMERUNS OVER 200 FEET SHALL BE #10 AWG MINIMUM... 26. CONDUIT FOR TELEPHONE/DATA CABLING SHALL COMPLY WITH THE FOLLOWING ADDITIONAL REQUIREMENTS: a. INSIDE BEND RADIUS SHALL BE AT LEAST 10 TIMES ITS INTERNAL DIAMETER... b. PROVIDE PULL BOXES WHENEVER CONDUIT LENGTH EXCEEDS 150 FEET AND WHEN COMBINED BENDS ARE GREATER THAN 180 DEGREES... c. ALL CONDUIT SHALL BE PROVIDED WITH INSULATED BUSHINGS... d. MAINTAIN A MINIMUM CLEARANCE OF 4 FEET FROM MOTORS AND TRANSFORMERS... e. MAINTAIN A MINIMUM CLEARANCE OF 12 INCHES FROM POWER CIRCUITS... 27. COORDINATE MOUNTING HEIGHTS OF RECEPTACLES, SWITCHES, AV DEVICES, SECURITY DEVICES, ETC. MOUNTED ON COMMON WALLS SO THAT ALL OUTLETS ARE MOUNTED TO ALIGN HORIZONTALLY... 28. NOTIFY THE ARCHITECT IN WRITING WHEN INSTALLATION IS COMPLETE AND THAT A FINAL INSPECTION OF THIS WORK CAN BE PERFORMED... 7. SUBMITTALS WILL BE REVIEWED BY THE ELECTRICAL ENGINEER... 8. IN NO EVENT WILL ANY SITE VISITS BY THE ELECTRICAL ENGINEER... 9. COPIES OF THE PLANS PROVIDED IN ANY ELECTRONIC FORM ARE SUBJECT TO THE SAME PROVISIONS AS THE OTHER INSTRUMENTS OF SERVICE... 10. REFER TO THE DRAWINGS AND SHOP DRAWINGS OF OTHER TRADES FOR ADDITIONAL DETAILS WHICH AFFECT THE PROPER INSTALLATION OF THIS WORK... 11. BEFORE SUBMITTING A BID, THE CONTRACTOR SHALL FAMILIARIZE HIMSELF WITH ALL FEATURES OF THE BUILDING... 12. PROTECT ALL WORK, MATERIALS AND EQUIPMENT FROM DAMAGE FROM ANY CAUSE... 13. THE DRAWINGS INDICATE IN A DIAGRAMMATIC MANNER, THE DESIRED LOCATIONS OF ARRANGEMENT OF THE COMPONENTS OF ELECTRICAL WORK...

SYMBOL LIST

- (ALL SYMBOL NOT NECESSARILY USED ON THESE DRAWINGS) ALL SYMBOL DESCRIPTION ARE SUBJECT TO MODIFICATION AS NOTED ON THE DRAWINGS... AM-FM ANTENNA (VERIFY MOUNTING LOCATION) OUTLET BOX FOR CLOSED CIRCUIT CAMERA... HOME RUN TO MCA-11... PUSH BUTTON STATION WITH "STOP-START" PUSH BUTTONS AND RED INDICATING PILOT LIGHT... CONDUIT, INSTALLED CONCEALED IN WALL OR IN CEILING SPACE... CONDUIT, INSTALLED CONCEALED IN OR UNDER FLOOR OR BELOW GRADE... CONDUIT, INSTALLED EXPOSED... HOMERUN TO PANEL "B" FOR CIRCUITS 5, 7, 9 WITH COMMON NEUTRAL... UNDERGROUND CONDUIT STUBOUT... MOTOR CONNECTION... JUNCTION BOX, FLUSH IN FLOOR... FIRE ALARM BELL... COMBINATION DATA/POWER/AUDIO VIDEO FLOOR BOX... COMBINATION DATA/POWER/AUDIO VIDEO POKE THROUGH DEVICE... COMBINATION DATA/POWER FLOOR BOX WITH FOUR (4) DATA OUTLETS AND TWO (2) DUPLEX RECEPTACLES... COMBINATION DATA/POWER FLOOR BOX WITH SIX (6) DATA OUTLETS AND THREE (3) DUPLEX RECEPTACLES... COMBINATION DATA/POWER POKE-THRU... DEVICE WITH TWO (2) DUPLEX RECEPTACLES AND FOUR (4) DATA JACKS... COMBINATION DATA/POWER POKE-THRU... DEVICE WITH TWO (2) DUPLEX RECEPTACLES AND SIX (6) DATA JACKS... AUDIO/VIDEO OUTLET... AUDIO/VIDEO CONTROL PANEL... SWITCH FOR CONTROL OF LOW VOLTAGE LIGHTING RELAYS... DIMMING SYSTEM LIGHTING CONTROL STATION... LOW VOLTAGE LIGHTING ON/OFF CONTROL SWITCH... LOW VOLTAGE CLASSROOM LIGHTING ENTRANCE CONTROL STATION... LOW VOLTAGE INSTRUCTORS CLASSROOM LIGHTING DIMMING CONTROL STATION... LIGHTING CONTROL OCCUPANCY MOTION SENSOR... LIGHTING LEVEL CONTROLLER... LIGHTING CONTROL OCCUPANCY SENSOR... DUPLEX CONVENIENCE RECEPTACLE VERTICAL... DUPLEX CONVENIENCE RECEPTACLE HORIZONTAL... DUPLEX DUPLEX (FOUR-FLEX) CONVENIENCE RECEPTACLE... DUPLEX CONVENIENCE RECEPTACLE WITH INTERNAL GROUND FAULT INTERRUPTER... DOUBLE DUPLEX CONVENIENCE RECEPTACLE WITH INTERNAL GROUND FAULT INTERRUPTER... DUPLEX CONVENIENCE RECEPTACLE WITH INTERNAL GROUND FAULT INTERRUPTER... DOUBLE DUPLEX CONVENIENCE RECEPTACLE WITH INTERNAL GROUND FAULT INTERRUPTER... DUPLEX CONVENIENCE RECEPTACLE, IN FLUSH IN WALL OUTLET BOX... DOUBLE DUPLEX CONVENIENCE RECEPTACLE IN FLUSH FLOOR OUTLET BOX... DUPLEX CONVENIENCE RECEPTACLE, IN FLUSH FLOOR OUTLET BOX... JUNCTION BOX CONCEALED ABOVE ACCESSIBLE CEILING... INDICATES CONNECTION TO EQUIPMENT AS REQUIRED... THERMOSTAT ON FLUSH WALL MOUNTED OUTLET BOX... PANELBOARD, ADJACENT LINE INDICATES PANEL FRONT... FLOOR STANDING SWITCHGEAR ADJACENT BALLOON INDICATES EQUIPMENT DESIGNATION... TERMINAL CABINET OR EQUIPMENT CABINET... CIRCUIT BREAKER WITH ZERO SEQUENCE GROUND FAULT RELAY SYSTEM... TRANSFORMER; KVA, LINE AND LOAD VOLTAGE RATINGS AS INDICATED... FUSED SAFETY SWITCH (DISCONNECT), HORSE POWER RATED... LIGHTING FIXTURE, RECESS MOUNTED, WITH OUTLET BOX... LIGHTING FIXTURE, SURFACE OR PENDANT MOUNTED ON FLUSH MOUNTED OUTLET BOX... INDUSTRIAL LIGHTING FIXTURE, SURFACE, CHAIN OR PENDANT MOUNTED ON FLUSH MOUNTED OUTLET BOX... LIGHTING FIXTURE, SURFACE OR PENDANT MOUNTED, ON FLUSH CEILING MOUNTED OUTLET BOX... LIGHTING FIXTURE, RECESS MOUNTED, WITH OUTLET BOX... LIGHTING FIXTURE, SURFACE OR FLUSH MOUNTED AS INDICATED ON FIXTURE SCHEDULE... POST TOP LIGHTING STANDARD, POLE MOUNTED LUMINAIRE AND POLE SUPPORT BASE... LIGHTING FIXTURE WITH LAMPS ON NORMAL AND EMERGENCY LIGHTING CIRCUITS... LIGHTING FIXTURE RECESSED MOUNTED WITH OUTLET BOX AND REMOTE MOUNTED JUNCTION BOX... LIGHTING STANDARD WITH SINGLE ARM MOUNTED LUMINAIRE AND POLE SUPPORT BASE... LIGHTING STANDARD WITH TWIN ARM MOUNTED LUMINAIRES AND POLE SUPPORT BASE... UPLIGHT, MOUNTED FLUSH WITH FINISH GRADE... FLOODLIGHTING FIXTURE WITH WEATHERPROOF OUTLET BOX... TRACK LIGHTING WITH FIXTURE(S), CEILING, PENDANT, OR WALL MOUNTED... EXT SIGN SINGLE FACE... EXT SIGN DOUBLE FACE... EXT SIGN ON FLUSH WALL MOUNTED OUTLET BOX... EXT SIGN ON FLUSH WALL MOUNTED OUTLET BOX... EXT SIGN ON FLUSH WALL MOUNTED OUTLET BOX... 2 - DOUBLE POLE 3 - THREE WAY 4 - FOUR WAY P - PILOT LIGHT M - MANUAL MOTOR STARTERS K - KEY OPERATED R - SPD MOMENTARY CONTACT RELAY SWITCH V - VAPOR PROOF a,b,c,d, ETC. - MULTIPLE SWITCHES WITH IDENTIFICATION OF OUTLET CONTROLLED SWITCH FOR CONTROL OF LOW VOLTAGE LIGHTING RELAYS... DIMMING SYSTEM LIGHTING CONTROL STATION... LOW VOLTAGE LIGHTING ON/OFF CONTROL SWITCH... LOW VOLTAGE CLASSROOM LIGHTING ENTRANCE CONTROL STATION... LOW VOLTAGE INSTRUCTORS CLASSROOM LIGHTING DIMMING CONTROL STATION... LIGHTING CONTROL OCCUPANCY MOTION SENSOR... LIGHTING LEVEL CONTROLLER... LIGHTING CONTROL OCCUPANCY SENSOR... DUPLEX CONVENIENCE RECEPTACLE VERTICAL... DUPLEX CONVENIENCE RECEPTACLE HORIZONTAL... DUPLEX DUPLEX (FOUR-FLEX) CONVENIENCE RECEPTACLE... DUPLEX CONVENIENCE RECEPTACLE WITH INTERNAL GROUND FAULT INTERRUPTER... DOUBLE DUPLEX CONVENIENCE RECEPTACLE WITH INTERNAL GROUND FAULT INTERRUPTER... DUPLEX CONVENIENCE RECEPTACLE WITH INTERNAL GROUND FAULT INTERRUPTER... DOUBLE DUPLEX CONVENIENCE RECEPTACLE WITH INTERNAL GROUND FAULT INTERRUPTER... DUPLEX CONVENIENCE RECEPTACLE, IN FLUSH IN WALL OUTLET BOX... DOUBLE DUPLEX CONVENIENCE RECEPTACLE IN FLUSH FLOOR OUTLET BOX... DUPLEX CONVENIENCE RECEPTACLE, IN FLUSH FLOOR OUTLET BOX... JUNCTION BOX CONCEALED ABOVE ACCESSIBLE CEILING... INDICATES CONNECTION TO EQUIPMENT AS REQUIRED... THERMOSTAT ON FLUSH WALL MOUNTED OUTLET BOX... PANELBOARD, ADJACENT LINE INDICATES PANEL FRONT... FLOOR STANDING SWITCHGEAR ADJACENT BALLOON INDICATES EQUIPMENT DESIGNATION... TERMINAL CABINET OR EQUIPMENT CABINET... CIRCUIT BREAKER WITH ZERO SEQUENCE GROUND FAULT RELAY SYSTEM... TRANSFORMER; KVA, LINE AND LOAD VOLTAGE RATINGS AS INDICATED... FUSED SAFETY SWITCH (DISCONNECT), HORSE POWER RATED...

ABBREVIATIONS

Table with 2 columns: Abbreviation and Full Name. Includes entries like A.F.F. ABOVE FINISH FLOOR, A.F.G. ABOVE FINISH GRADE, AWG AMERICAN WIRE GAUGE, AMP, A AMPERE, A.I.C. AMPERES INTERRUPTING CAPACITY (SYMMETRICAL), AF/AT AMP FRAME, AMP TRIP, AS/AF AMP SWITCH, AMP FUSE, CIRC., CKT. CIRCUIT, CB CIRCUIT BREAKER, C CONDUIT, C.O. CONDUIT ONLY, CONN CONNECTED, CLCB CURRENT LIMITING CIRCUIT BREAKER, DIA DIAMETER, EMCS ENERGY MANAGEMENT CONTROL SYSTEM, EMT ELECTRICAL METALLIC TUBING, EWC ELECTRIC WATER COOLER, E-O-L END-OF-LINE CIRCUIT TERMINATOR, EF EXHAUST FAN, FT OR ' FEET, FA FIRE ALARM, FLA FULL LOAD AMPS, GFI GROUND FAULT INTERRUPTER, GRD GROUND, HOA HAND-OFF-AUTO, HVAC HEATING, VENTILATING AND AIR CONDITIONING, H, W, D, L HEIGHT, WIDTH, DEPTH, LENGTH, HID HIGH INTENSITY DISCHARGE, HP HORSEPOWER, HPS HIGH PRESSURE SODIUM, IN OR ' INCHES, IG ISOLATED GROUND, J-BOX JUNCTION BOX, KVA KILOVOLT AMPERES, KW KILOWATT, LCL LONG CONTINUOUS LOAD, L.F. LINEAR FEET, LTG, LTS LIGHTING, MCB MAIN CIRCUIT BREAKER, MLO MAIN LUGS ONLY, MH METAL HALIDE, MCC MOTOR CONTROL CENTER, MCM THOUSAND CIRCULAR MILS, MCP MOTOR CIRCUIT PROTECTOR MOUNTED, MTD MICROWAVE, NEC NATIONAL ELECTRIC CODE, NC NORMALLY CLOSED, NO NORMALLY OPEN, NF NON-FUSED, NC NOT IN CONTRACT, NO OR # NUMBER, OFC OWNER FURNISHED, CONTRACTOR INSTALLED, PRIMARY OVER 600 VOLTS, PH, OR# PHASE, PROVIDE FURNISH, INSTALL AND CONNECT, PA PUBLIC ADDRESS, REC, RECEPT RECEPTACLE, U.N.O. UNLESS NOTED OTHERWISE

FIRE ALARM NOTES

FIRE ALARM SUBMITTAL IS A COMPLETE PLAN SUBMITTAL IN ACCORDANCE WITH PROJECT SUBMITTAL GUIDELINE, GL-2(FLS) DATED 2/10/11

CABLE INSTALLATION NOTES

- (APPLIES ONLY TO DATA NETWORK) 1. WHERE ACCESSIBLE SUSPENDED T-BAR CEILINGS OCCUR, CABLING FOR THE ABOVE REFERENCED SYSTEMS SHALL BE PROVIDED ROUTED VIA CABLE TRAY/BASKET TRAY... 2. CONDUITS SHALL BE PROVIDED WHERE CABLES ARE INSTALLED IN WALLS, BELOW GRADE AND AREAS OTHER THAN ABOVE REFERENCED SUSPENDED T-BAR CEILINGS... 3. CONDUITS SHALL BE PROVIDED WHERE CABLES ARE INSTALLED IN WALLS, BELOW GRADE AND AREAS OTHER THAN ABOVE REFERENCED SUSPENDED T-BAR CEILINGS, CABLING INSTALLED UNDERGROUND SHALL BE SUITABLE FOR UNDERGROUND INSTALLATIONS.

ANCHORAGE NOTES

MEP COMPONENT ANCHORAGE NOTE ALL MECHANICAL, PLUMBING, AND ELECTRICAL COMPONENTS SHALL BE ANCHORED AND INSTALLED PER THE DETAILS ON THE DSA APPROVED CONSTRUCTION DOCUMENTS... 1. ALL PERMANENT EQUIPMENT AND COMPONENTS, 2. TEMPORARY OR MOVABLE EQUIPMENT THAT IS PERMANENTLY ATTACHED... 3. MOVABLE EQUIPMENT WHICH IS STATIONED IN ONE PLACE FOR MORE THAN 8 HOURS AND HEAVIER THAN 400 POUNDS... THE FOLLOWING MECHANICAL AND ELECTRICAL COMPONENTS SHALL BE POSITIVELY ATTACHED TO THE STRUCTURE... FOR THOSE ELEMENTS THAT DO NOT REQUIRE DETAILS ON THE APPROVED DRAWINGS, THE INSTALLATION SHALL BE SUBJECT TO THE APPROVAL OF THE DESIGN PROFESSIONAL IN GENERAL... MECHANICAL PIPING (MP), MECHANICAL DUCTS (MD), PLUMBING PIPING (PP), ELECTRICAL DISTRIBUTION SYSTEMS (ES)

MECHANICAL PIPING (MP), MECHANICAL DUCTS (MD), PLUMBING PIPING (PP), ELECTRICAL DISTRIBUTION SYSTEMS (ES) MP MD PP E - OPTION 1: DETAILED ON THE APPROVED DRAWINGS WITH PROJECT SPECIFIC NOTES AND DETAILS. MP MD PP E - OPTION 2: SHALL COMPLY WITH APPLICABLE OSHPD PRE-APPROVAL (OPMH) # _____. MP MD PP E - OPTION 3: SHALL COMPLY WITH THE SMACNA SEISMIC RESTRAINT MANUAL, OSHPD EDITION (2009), INCLUDING ANY ADDENDA, FASTENERS AND OTHER ATTACHMENTS NOT SPECIFICALLY IDENTIFIED IN THE SMACNA SEISMIC RESTRAINT MANUAL, OSHPD EDITION, ARE BASED ON THE APPROVED DRAWINGS WITH PROJECT SPECIFIC NOTES AND DETAILS...

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Project information including file name (E0-0.1), date (04/08/2019), and drawing title (SYMBOL LIST, NOTES AND DETAILS). Includes a drawing title 'E0-0.1' and 'drawing of'.

Professional seals and logos for architecture and engineering firms: DIVISION OF THE STATE ARCHITECT, BPP Architecture, FBA Engineering, and Compton College.

Large vertical text for 'COMPTON COLLEGE INSTRUCTIONAL BUILDING No.2' and 'COMPTON COMMUNITY COLLEGE DISTRICT'.

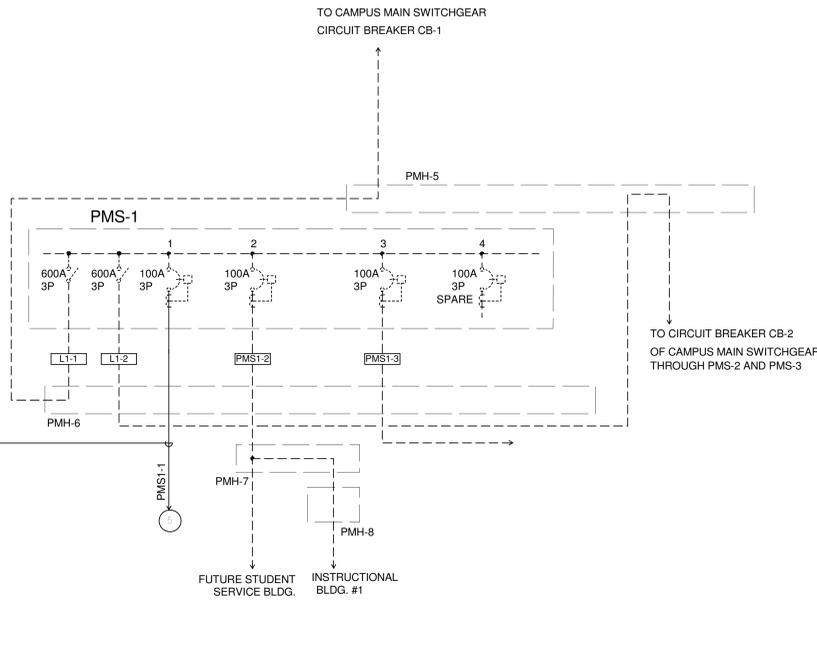
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FEEDER SCHEDULE

COPPER CONDUCTORS
THW 600V (AWG)

FEEDER TYPE	QUAN.	SIZE	CONDUCTORS IN EACH CIRCUIT		EQUIPMENT GROUND WIRE SIZE
			PHASE/NEUTRAL		
F20	1	3/4"	4	12	12
F30	1	3/4"	4	10	10
F40	1	1"	4	8	10
F50	1	1 1/4"	4	6	10
F60	1	1 1/2"	4	4	10
F70	1	1 1/2"	4	4	8
F80	1	2"	4	2	8
F90	1	2"	4	2	8
F100	1	2"	4	1	8
F110	1	2"	4	1	6
F125	1	2"	4	1/0	6
F150	1	2"	4	1/0	6
F175	1	2"	4	2/0	6
F200	1	2 1/2"	4	3/0	6
F225	1	3"	4	4/0	4
F250	1	3"	4	250MCM	4
F275	1	4"	4	350MCM	4
F300	1	4"	4	350MCM	4
F350	1	4"	4	500MCM	2
F400	2	2 1/2"	4	3/0	2
F500	2	3"	4	250MCM	2
F600	2	4"	4	350MCM	1
F700	2	4"	4	500MCM	1/0
F800	3	4"	4	350MCM	1/0
F900	3	4"	4	350MCM	2/0
F1000	3	4"	4	500MCM	2/0
F1200	4	4"	4	350MCM	3/0
F1600	5	4"	4	500MCM	4/0
F2000	6	4"	4	500MCM	250MCM
F2500	7	4"	4	500MCM	350MCM
F3000	8	4"	4	500MCM	500MCM
F4000	11	4"	4	500MCM	500MCM
F20/N	1	3/4"	3	12	12
F30/N	1	3/4"	3	10	10
F40/N	1	1"	3	8	10
F50/N	1	1"	3	6	10
F60/N	1	1 1/4"	3	4	10
F70/N	1	1 1/4"	3	4	8
F80/N	1	1 1/4"	3	2	8
F90/N	1	1 1/4"	3	2	8
F100/N	1	1 1/2"	3	1	8
F110/N	1	1 1/2"	3	1	6
F125/N	1	2"	3	1/0	6
F150/N	1	2"	3	1/0	6
F175/N	1	2"	3	2/0	6
F200/N	1	2"	3	3/0	6
F225/N	1	2 1/2"	3	4/0	4
F250/N	1	2 1/2"	3	250MCM	4
F275/N	1	3"	3	350MCM	4
F300/N	1	3"	3	350MCM	4
F350/N	1	4"	3	500MCM	2
F400/N	2	2 1/2"	3	3/0	2
F500/N	2	3"	3	250MCM	2
F600/N	2	4"	3	350MCM	1
F700/N	2	4"	3	500MCM	1/0
F800/N	3	4"	3	350MCM	1/0
F900/N	3	4"	3	350MCM	2/0
F1000/N	3	4"	3	500MCM	2/0
F1200/N	4	4"	3	350MCM	3/0
F1600/N	5	4"	3	500MCM	4/0
F2000/N	6	4"	3	500MCM	250MCM
F2500/N	7	4"	3	500MCM	350MCM
F3000/N	8	4"	3	500MCM	500MCM
F4000/N	11	4"	3	500MCM	500MCM
F350/U	-	-	-	-	-
F400/U	2	3"	4	4/0	2
F500/U	2	4"	4	350MCM	1/0
F600/U	2	4"	4	500MCM	2/0
F700/U	2	4"	4	500MCM	2/0
F800/U	3	4"	4	350MCM	2/0
F900/U	3	4"	4	500MCM	4/0
F1000/U	3	4"	4	500MCM	4/0
F1200/U	4	4"	4	500MCM	250MCM
F1600/U	6	4"	4	500MCM	250MCM
F2000/U	8	4"	4	500MCM	350MCM
F2500/U	9	4"	4	500MCM	500MCM
F3000/U	11	4"	4	500MCM	500MCM
F4000/U	15	4"	4	500MCM	500MCM
F350/DN	-	-	-	-	-
F400/DN	2	3"	3	4/0	2
F500/DN	2	4"	3	350MCM	1/0
F600/DN	2	4"	3	500MCM	1/0
F700/DN	2	4"	3	500MCM	1/0
F800/DN	3	4"	3	350MCM	2/0
F900/DN	1	1 1/2"	3/1	4/1	10
F1000/DN	1	2"	3/1	1/2/0	8
F125/DN	1	2 1/2"	5	1/0	6
F150/DN	1	2 1/2"	5	1/0	4
F225/DN	1	3"	5	4/0	4
F300/DN	1	4"	5	350MCM	2
F400/DN	2	3"	5	3/0	2
F600/DN	2	4"	5	350MCM	1
F800/DN	3	5"	5	350MCM	1/0
F1200/DN	4	4"	5	350MCM	3/0
F1600/DN	5	5"	5	500MCM	4/0

- SINGLE LINE DIAGRAM GENERAL NOTES:**
1. THE INTERRUPTING CAPACITY OF THE CIRCUIT BREAKERS IN 120/208 VOLT PANELBOARDS SHALL BE 10,000 A.I.C. TYPICAL, UNLESS NOTED OTHERWISE OR REQUIRED BY THE SHORT CIRCUIT STUDY.
 2. CIRCUIT BREAKERS IN 120/208 VOLT DISTRIBUTION BOARDS SHALL BE SERIES RATED WITH DOWNSTREAM PANELBOARDS CIRCUIT BREAKERS FOR 22,000 A.I.C. UNLESS NOTED OTHERWISE OR REQUIRED BY THE SHORT CIRCUIT STUDY.
 3. THE INTERRUPTING CAPACITY OF THE CIRCUIT BREAKERS IN 480/277 VOLT PANELBOARD SHALL BE 18,000 A.I.C. TYPICAL, UNLESS NOTED OTHERWISE OR REQUIRED BY THE SHORT CIRCUIT STUDY.
 4. CIRCUIT PROTECTIVE DEVICES IDENTIFIED AS "SERIES RATED" OR "CURRENT LIMITING" (I.E. SR-SERIES RATED CIRCUIT BREAKER, CLCB-CURRENT LIMITING CIRCUIT BREAKER, CL-FUSE, CURRENT LIMITING FUSE, ETC.) SHALL BE SERIES RATED AND TESTED (UL 489 & CSA5) BY THE MANUFACTURER WITH ALL EQUIPMENT AND CIRCUIT PROTECTIVE DEVICES INSTALLED DOWN STREAM OF THE IDENTIFIED SERIES RATED OR CURRENT LIMITING DEVICE FOR 65,000 A.I.C. PROVIDE NAME PLATES ON ALL EQUIPMENT LOCATED DOWN STREAM, INCLUDING THE SR, CLCB AND CLF DEVICES, TO COMPLY WITH C.E.C. PARAGRAPHS 110-22 AND 240-86 "CAUTION SERIES RATED COMBINATION SYSTEM RATED NEW DEVICE INSTALLATIONS AND REPLACEMENTS SHALL BE OF THE SAME MANUFACTURER AND MODEL".
 5. CIRCUIT BREAKERS RATED 1,200 AMPS AND GREATER SHALL COMPLY WITH ARC ENERGY REDUCTION PER C.E.C. 240.87 AND PER SPECIFICATIONS 262413.
 6. PROVIDE SHORT CIRCUIT PROTECTIVE DEVICE COORDINATION AND ARC-FLASH STUDY INCLUDING THE ENGINEERED SETTINGS FOR EACH FUSE AND ADJUSTABLE CIRCUIT BREAKER SHOWING THE CORRECT TIME AND CURRENT SETTINGS TO PROVIDE COORDINATION WITH THE LIMITS OF THE SPECIFIED EQUIPMENT. REFER TO SPECIFICATIONS 262413 FOR ADDITIONAL REQUIREMENTS.
 7. MAIN ELECTRICAL SERVICE SHALL NOT BE ENERGIZED UNTIL BUILDING INSPECTORS RECEIPT AND APPROVAL OF A THIRD PARTY NRTL TESTING LABORATORY PERFORMANCE TEST CERTIFICATION FOR THE SERVICE GROUND FAULT PROTECTION PER C.E.C. 230.95.
 8. THE DIMENSIONS USED FOR SWITCHBOARDS ARE BASED UPON SOD MANUFACTURED PRODUCTS. IF ANOTHER MANUFACTURER'S PRODUCT IS FURNISHED, CONTRACTOR SHALL INSURE THAT THE PRODUCT WILL FIT WITHIN THE SPACE PROVIDED.



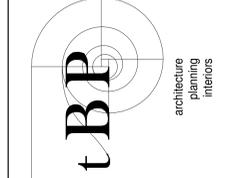
DETAIL "B" - SWITCH "PMS1" PARTIAL SINGLE LINE DIAGRAM

COMPTON COLLEGE BLDG IB2
MAIN SWITCHBOARD "MDBH" LOAD CALCULATION

LOAD DESCRIPTION	CONNECTED (KVA)	CONNECTED CURRENT(A)	REMARKS
PANEL HA1	20775	25	
AHU-2	102215	123	
ELEVATOR	33240	40	
PANEL DHM1	45705	55	
		0	
PANEL DPP1	135720	163.32	
PANEL DPP2	106200	127.8	
TOTAL CONNECTED LOADS	443853	534	

- PLAN NOTES:
1. PROVIDE SHUNT TRIP MECHANISM ON MAIN CIRCUIT BREAKER SERVING THE ELEVATOR. THE HEAT DETECTORS IN THE ELEVATOR MACHINE ROOM AND ON TOP OF ELEVATOR SHAFT, UPON DETECTION OF HEAT, SHALL SHUTDOWN POWER TO THE ELEVATOR. INSTALL IN ACCORDANCE WITH ASME 17.1, NFPA AND ELEVATOR MANUFACTURER'S REQUIREMENTS.
 2. PROVIDE (3) 1/0, 8KV, 115 MIL/133%, EPR, MV-105 UL CLASS & TEMP RATING, T5 SHIELDING, COPPER, (1) #6 GRD. - (N) 4"C.
 3. 225 AMPERE - 120/208V 3PH 4W ELECTRONIC GRADE PANELBOARD WITH MAIN CIRCUIT BREAKER, INTERNAL SURGE PROTECTOR DEVICE (SPD), EQUIPMENT GROUND AND ISOLATED GROUND BUS.
 4. PROVIDE COMPLETE NETWORKED METERING SYSTEM PER SPECIFICATION STATION 26 0910.
 5. SEE DETAIL "A" ON THIS SHEET FOR CONTINUATION.
 6. SEE DETAIL "B" ON THIS SHEET FOR CONTINUATION.
 7. PROVIDE 3/4" - 2#10, 1#10 GRD.
 8. 100 AMPERE - 120/208V 3PH 4W ELECTRONIC GRADE PANELBOARD WITH MAIN CIRCUIT BREAKER, INTERNAL SURGE PROTECTOR DEVICE (SPD), EQUIPMENT GROUND AND ISOLATED GROUND BUS.

DIVISION OF THE STATE ARCHITECT
355 South Grand Avenue, Suite 2100
Los Angeles, CA 90012
ph: (213) 897-3995 fx:(213) 897-3159
agency



IBP/Architecture
4611 Teller Avenue
Newport Beach, CA 92660
ph: 949.673.0000 fx: 949.732.3895
architect



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:
1 08/02/19 Addendum 1
2 09/04/19 Addendum 2
3 09/12/19 Addendum 3

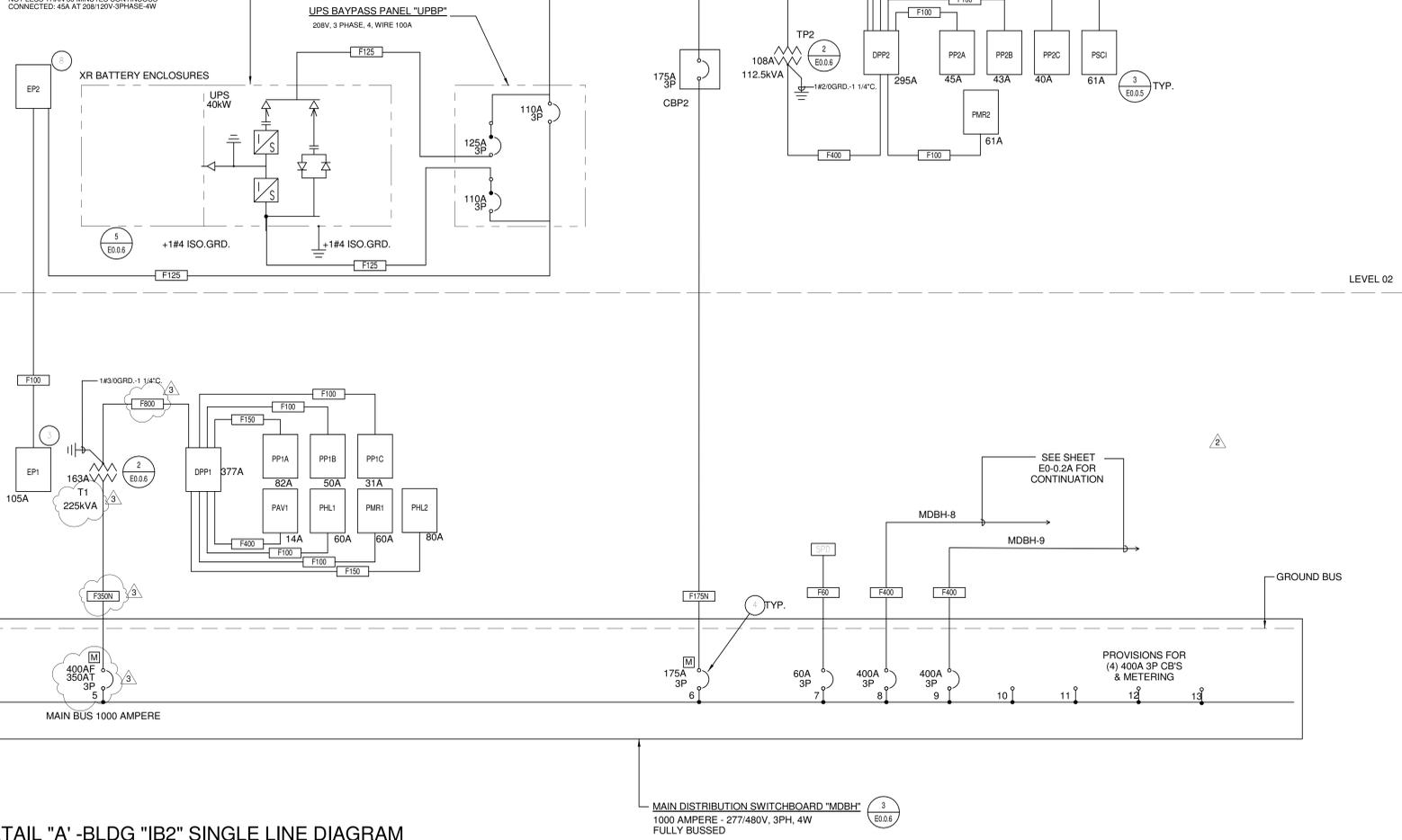
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drawing title:
SINGLE LINE DIAGRAM

drawing of
E0-0.2

UNINTERRUPTIBLE POWER SUPPLY "UPS"

UPS INPUT VOLTAGE: 208V, 3 PHASE, 43 WIRE
UPS OUTPUT VOLTAGE: 208/120V, 3 PHASE, 4 WIRE
EATON "93PM" SERIES
UPS FULL RATED LOAD CONTINUOUS
30KW @ 1.0 POWER FACTOR
27KW @ 0.9 POWER FACTOR
RUNNING TIME ON BATTERY CAPACITY
NOT LESS THAN 30 MINUTES CONTINUOUS
CONNECTED: 45A AT 208/120V-3PHASE-4W



DETAIL "A" - BLDG "IB2" SINGLE LINE DIAGRAM

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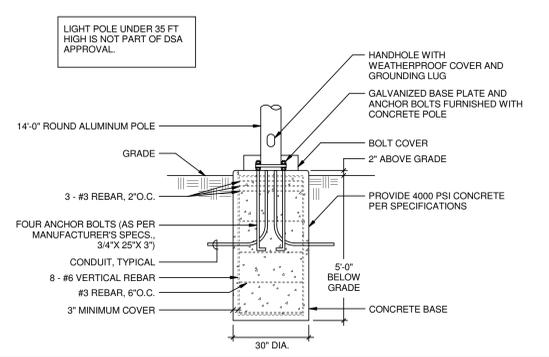
LEVEL 01

LIGHTING FIXTURE SCHEDULE												
FIXTURE TYPE	Count	LIGHT FIXTURE DESCRIPTION	FIXTURE MAXIMUM TOTAL INPUT WATTS	FIXTURE MOUNTING	LAMP TYPE	LAMP COLOR TEMPERATURE K	LAMP CRI, NOT LESS THAN	TOTAL ALL LAMPS INITIAL MINIMUM LUMEN OUTPUT	LAMP QUANTITY	WEIGHT	MOUNTING DETAIL	LTG - CATALOG NUMBER
A1	8	LED 2X4, CENTER DIFFUSER INTEGRAL 0-10V, DIMMING DRIVER.	61	RECESSED	LED	4000	82	5000		27.3 LBS		FOCAL POINT "EQUATION 2" SERIES #FEQ2-24-5500L-40K-1C-UNV-L11-G-WH FINELITE, INC. HPR-A-2X4-SCO-H-DIM1-VOLT-SC-C1 OR EQUAL.
B1	38	LED DOWNLIGHT, 6" APERTURE CLEAR DIFFUSER SELF FLANGE REFLECTOR; INTEGRAL 0-10V, DIMMING DRIVER.	29	RECESSED	LED	4000	90	2500		5 LBS		FOCAL POINT "ID +6" SERIES #FLC6D-RO-2500L-277-L11-T-LC6-RD-2000 L-940K-DN-CD-NP HE WILLIAMS, INC. 6DR-TL-L30/940-DIM1-UNV-OW-OF-SG-N-F1 OR EQUAL.
C1	15	LED STRIP LIGHT, LENSED, 4 FOOT LENGTH; INTEGRAL 0-10V, DIMMING BALLAST	23	SURFACE	LED	4000	82	2857		8.2 LBS		METALUX "SILED" SERIES #4SNLED-LD5-27SL-LW-UNV-L8XX-CD1-U HE WILLIAMS, INC. 75R-4-L30/840-DIM-UNV OR EQUAL.
C2	9	LED CHAIN SUSPENDED STRIP LIGHT, LENSED, 4 FOOT LENGTH; INTEGRAL 0-10V, DIMMING BALLAST	23	CHAIN	LED	4000	82	2857		8.2 LBS		METALUX "SILED" SERIES #4SNLED-LD5-27SL-LW-UNV-L8XX-CD1-U HE WILLIAMS, INC. 75R-4-L30/840-DIM-UNV OR EQUAL.
D1	29	LED LINEAR LIGHT FIXTURE, 6" WIDE, SOLID REGRESSED TRIM, 4 FOOT LENGTH INTEGRAL 0-10V, DIMMABLE DRIVER(S).	58	RECESSED	LED	4000	82			30 LBS		FOCAL POINT "AVENUE 6" SERIES #FVBL-SR-625L-F-40K-1C-UNV-L11-F-WH-4 STARFIRE LIGHTING INC. VRSL-840-S-S-48" F2 OR EQUAL.
E1	4	LED 72" RING FIXTURE	73	CABLE	LED	4000	82	6155		100 LBS		EUREKA "CYCLE" SERIES #4800-72-LED-UNV-40-DV-AC-60-RCC-WHM BETA CALCO A65-BH4-D2-P1-BF1-BG1-L2 OR EQUAL.
F1	14	LED LINEAR WALL WASH LIGHT FIXTURE IN CUSTOM LENGTHS AS SHOWN ON DRAWINGS; INTEGRAL DIMMABLE DRIVERS.	28/4 FT	RECESSED	LED	4000	82					FOCAL POINT "FOCUS WALL WASH" #FWSL-FL-450LF-40K-1C-UNV-L11-U-WH-X X FINELITE, INC. HP-WG-6W-4-X-H-840-VOLT-SC-WB-SSA-X X-XX OR EQUAL.
G1	6	LED DIRECT/INDIRECT LUMINAIRE 9" X 2 1/2" ALUMINUM HOUSING IN FINISH AS SELECTED BY ARCHITECT; 8'-0" LENGTH (SEE DRAWING FOR OVERALL LENGTH) CABLE SUSPENSION TO MOUNTING HEIGHT INDICATED ON DRAWINGS; FINISH AS SELECTED BY ARCHITECT.	158.4	CABLE	LED	4000	80					CORELITE #VB-W5-5-L40-1-D-UNV-AC-48-T1-XX-HLO-CC FINELITE, INC. SERIES 16LED ID-DCO-X-3E-V-V-840-OPEN-VOLT-FA-EE-C 1 OR EQUAL BY LEDALITE, PEERLESS
SL1	37	LED DECORATIVE WALKWAY LIGHT; TYPE IV DISTRIBUTION; ON 12'-0", 4" DIAMETER, 7 GAUGE STEEL POLE; 120 LUXEON LED EMITTERS; ADVANCE DRIVER; INTERNAL WIRELESS LED CONTROLLER; FIXTURE AND POLE FINISH AS SELECTED BY ARCHITECT; PROVIDE COMPLETE WITH ANCHOR BOLTS AND BOLT COVER.	165	POLE	LED	4000	82	5816		20 LBS		FORMULA TECHNOLOGIES #SBMTL-2626-IV 120LED-208V-350MA 12(4" ROUND) 7 GAUGE STRAIGHT STEEL POLE. FINISH AS SELECTED BY ARCHITECT.
SL2	12	LED SHARP CUT OFF WALL LIGHT; TRAPEZOIDAL SHAPE; INTEGRAL DRIVER; WET LOCATION; TYPE 3 DISTRIBUTION.	44	WALL	LED	4000	82	3500				MCGRAW EDISON "GALLEON" WALL MOUNT #GWC-AF-1-LED-EI-T3 HE WILLIAMS, INC. VWPH-L30/740-T3-DBZ-CGL-DIM-UNV OR EQUAL BY PHILLIPS GARDCO; LITHONIA "D" SERIES.
SL3	2	LED DOWNLIGHT, 6" APERTURE CLEAR DIFFUSER SELF FLANGE REFLECTOR; INTEGRAL 0-10V, DIMMING DRIVER.	29	RECESSED	LED	4000	90	2500		5 LBS		FOCAL POINT "ID +6" SERIES #FLC6D-RO-2500L-277-L11-T-LC6-RD-2000 L-940K-DN-CD-NP HE WILLIAMS, INC. 6DR-TL-L30/940-DIM1-UNV-OW-OF-SG-N-F1 OR EQUAL.
SL4	1	LED STEP LIGHT FIXTURE	7.7	RECESSED	LED	4000	80	312		2.60 LBS		WE-EF LIGHTING "STN254" SERIES #615-1520-LED-UNV-40K-ETL FC LIGHTING FC SL110-VOLT-LED-4K-450-STD FINISH OR EQUAL.
X1	5	LED EXIT SIGN, EDGE LIT, GREEN LETTERS, MIRRORING BACKING, CEILING MOUNT.	3	CEILING	LED							ISOLITE "ELT-FT" SERIES EMERGI-LITE WLX-42/43N-G-M-UA-2CKT OR EQUAL.
X2	7	LED EXIT SIGN, EDGE LIT, GREEN LETTERS, MIRRORING BACKING, WALL MOUNT.	3	WALL	LED							ISOLITE "ELT-FT" SERIES EMERGI-LITE WLX-42/43N-G-M-UA-2CKT OR EQUAL.

Grand total: 394

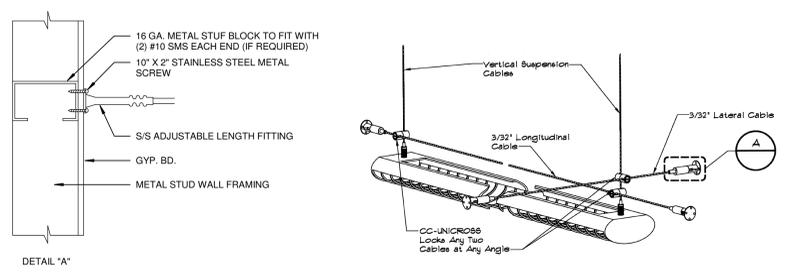
FIXTURE NOTES

- (NOTE: REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS)
- FIXTURES LOCATED OUTDOORS SHALL BE RATED FOR STARTING AND OPERATING TEMPERATURES BELOW 0 DEGREES FAHRENHEIT.
 - FIXTURES WITH THE SAME TYPE # SHALL BE THE PRODUCTS OF THE SAME MANUFACTURER, (I.E., TYPE #1, 1A, 1B, ETC., SHALL BE THE SAME MANUFACTURER).
 - THE CONTRACTOR SHALL VERIFY ACTUAL CEILING AND WALL CONSTRUCTION TYPE AS DEFINED ON THE ARCHITECTURAL DRAWINGS AND FURNISH LIGHTING FIXTURES WITH THE CORRECT AND COMPLETE MOUNTING HARDWARE AND MOUNTING DEVICES TO ACCOMMODATE BUILDING CONSTRUCTION AT EACH INSTALL LOCATION, WHETHER OR NOT SUCH VARIATIONS ARE INDICATED BY THE FIXTURE CATALOG NUMBER.
 - THE CONTRACTOR SHALL VERIFY DEPTH OF ALL RECESSED LIGHTING FIXTURES WITH ARCHITECTURAL DRAWINGS PRIOR TO ORDERING FIXTURES. ANY DISCREPANCIES THAT WILL CAUSE RECESSED FIXTURES NOT TO FIT INTO CEILING/WALL SPACES SHALL BE REPORTED TO THE OWNER'S REPRESENTATIVE PRIOR TO SUBMITTING SHOP DRAWINGS AND PRIOR TO ORDERING FIXTURES.
 - LIGHT FIXTURES RECESSED IN CEILING OR WALL WITH A ONE HOUR OR MORE FIRE RATING BUILDING CONSTRUCTION, EACH FIXTURE SHALL BE ENCLOSED IN A BOX WHICH HAS A FIRE RATING EQUAL TO THAT OF THE BUILDING CONSTRUCTION. PROVIDE MINIMUM OF 3" CLEAR FROM ALL SIDES AND TOP OF RECESSED LIGHT FIXTURES.
 - WALL AND CEILING INSULATION SHALL BE INSTALLED TO ALLOW 3" MINIMUM CLEARANCE FROM BOTTOM, SIDES AND TOP OF RECESSED LIGHT FIXTURES.
 - VERIFY MOUNTING HEIGHT OF ALL WALL MOUNTED FIXTURES WITH ARCHITECT PRIOR TO ROUGH-IN.
 - REFER TO ARCHITECTURAL REFLECTED CEILING PLANS AND WALL ELEVATIONS FOR EXACT INSTALL LOCATION OF ALL FIXTURES.
 - VERIFY VOLTAGE BEING SUPPLIED TO FIXTURES PRIOR TO SUBMITTING SHOP DRAWINGS AND PRIOR TO ORDERING. FIXTURE VOLTAGE SHALL MATCH BRANCH CIRCUITS CONNECTING TO RESPECTIVE FIXTURE.
 - SUSPENDED MOUNT LIGHT FIXTURES THAT MAY STRIKE STRUCTURAL ELEMENTS, WALL OR MECHANICAL DUCT WORK IF SWIVELED AT +45 DEGREES SHALL BE SWAY BRACED WITH AIR CRAFT CABLE TO PREVENT STRIKING SAID APPURTENANCES DURING SEISMIC EVENTS, AS REQUIRED.
 - OCCUPANCY MOTION SENSOR SYSTEM SHALL BE PROVIDED IN EVERY ROOM/SPACE LOCATION THROUGHOUT THE FACILITY AND AS DESCRIBED IN THE SPECIFICATIONS, WHETHER SYMBOLS ARE SHOWN OR NOT SHOWN ON THE PLANS.
 - PROVIDE TESTING CERTIFICATION AND COMMISSIONING OF LIGHTING FIXTURES, INSTALLATION, LIGHTING CONTROL SYSTEM AND LIGHTING SYSTEM OPERATION.
 - CONTRACTOR SHALL COORDINATE INSTALLATION OF RECESSED LIGHTING FIXTURES IN HARD LID OR STUCCO CEILING AREAS WITH FRAMING CONTRACTOR.
 - ALL EDGE-LIT EXIT SIGNS SHALL HAVE MIRRORING BACKING.



POLE BASE DETAIL - WALKWAY A

- WHERE PENDANT MOUNTED LIGHT FIXTURES ARE TO BE INSTALLED IN AREAS WITH A SUSPENDED CEILING, THE CONSTRUCTION DOCUMENTS SHALL INCLUDE COMPLETE SUPPORT DETAILS COMPLYING WITH THIS IR AND DSA IR 16-9.
- SUPPORT PENDANT MOUNTED LIGHT FIXTURES DIRECTLY FROM THE STRUCTURE ABOVE WITH HANGER WIRES OR CABLES PASSING THROUGH EACH PENDANT HANGER AND CAPABLE OF SUPPORTING TWO (2) TIMES THE WEIGHT OF THE FIXTURE.
- IF A PENDANT MOUNTED LIGHT FIXTURE IS DIRECTLY AND INDEPENDENTLY BRACED BELOW THE CEILING (I.E. AIRCRAFT CABLES TO WALLS), THEN A BRACE ASSEMBLY IS NOT REQUIRED ABOVE THE CEILING.
- IF A PENDANT MOUNTED LIGHT FIXTURE IS FREE TO SWING 45 DEGREES FROM VERTICAL IN ALL DIRECTIONS, AND IS NOT DIRECTLY AND INDEPENDENTLY BRACED BELOW THE CEILING, THEN A BRACING ASSEMBLY IS ONLY REQUIRED WHERE THE PENDANT HANGER PENETRATES THE CEILING. SPECIAL DETAILS ARE REQUIRED TO ATTACH THE PENDANT HANGER TO THE BRACING ASSEMBLY TO TRANSMIT THE HORIZONTAL AND VERTICAL FORCES. EXCEPTION: WHERE THE WEIGHT OF THE FIXTURE IS LESS THAN 20 POUNDS, THE VERTICAL COMPONENT OF THE BRACE FORCE NEED NOT BE CONSIDERED SO NO COMPRESSION STRUT/POST IS REQUIRED.
- RIGID CONDUIT SHALL NOT BE USED FOR ATTACHMENT OF THE FIXTURES.



PENDANT MOUNTED LIGHT FIXTURE ANCHORAGE B

INVERTER PANEL SCHEDULE: EMH							
Project: INSTRUCTIONAL BUILDING NO. 2							
Location: Space 397							
Supply From: HL1							
Volts: 480/277 Wye							
CKT	Circuit Description	Voltage	Quantity	Rating	Number of Poles	Load	Control
1	1ST & 2ND FLOOR ELECTRICAL/TELECOM ROOMS	277 V	8	20 A	1	184 VA	LC
2	1ST FLOOR CORRIDOR	277 V	9	20 A	1	151 VA	LC
3	1ST FLOOR EXIT SIGNS	277 V	14	20 A	1	828 VA	LC
4	2ND FLOOR CORRIDOR	277 V	4	20 A	1	12 VA	LC
5	2ND FLOOR EXIT SIGN	277 V	3	20 A	1	674 VA	LC
6	EXTERIOR LIGHTING	277 V	15	20 A	1	588 VA	LC
7	Spare	--	--	20 A	1	0 VA	
8	Spare	--	--	20 A	1	0 VA	
9	Spare	--	--	20 A	1	0 VA	
10	Spare	--	--	20 A	1	0 VA	
11	Spare	--	--	20 A	1	0 VA	
12	Spare	--	--	20 A	1	0 VA	
13	Spare	--	--	20 A	1	0 VA	
14	Spare	--	--	20 A	1	0 VA	
15	Spare	--	--	20 A	1	0 VA	
16	Spare	--	--	20 A	1	0 VA	
17	Spare	--	--	20 A	1	0 VA	
18	Spare	--	--	20 A	1	0 VA	
19	Spare	--	--	20 A	1	0 VA	
20	Spare	--	--	20 A	1	0 VA	
						Total Conn. Load:	2244 VA
						Total Amps:	3 A

Notes:
 P/TTC - PHOTOCCELL ON / TIMECLOCK OFF FUNCTION OF LIGHTING CONTROL PANEL
 P/CPC - PHOTOCCELL ON / PHOTOCCELL OFF FUNCTION OF LIGHTING CONTROL PANEL
 LC - LIGHTING CONTROL SYSTEM

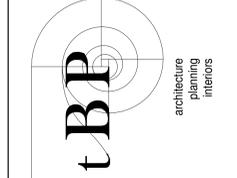
PERFORMANCE NOTES:
 1. ALL LED DRIVERS SHALL BE DIMMABLE AND COMPATIBLE WITH THE SPECIFIED LUTRON
 2. QUANTUM "ECO" LIGHTING CONTROL SYSTEM

LIGHTING CONTROL RELAY SCHEDULE "MLCP"

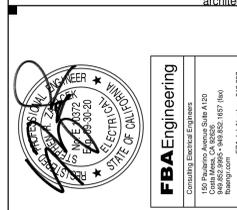
RELAY	CKT. NO.	SWITCH	MASTER SWITCH	AREA CONTROLLED
1	HL1-5	P/T	-	WALKWAY LIGHTS
2	HL1-7	P/P	-	WALKWAY LIGHTS
3	HL1-6	P/T	-	WALKWAY LIGHTS
4	HL1-8	P/P	-	WALKWAY LIGHTS
5	HL1-EMH-6	P/P	-	BUILDING EXT - LIGHTS
6	-	-	-	PROVISION
7	-	-	-	PROVISION
8	-	-	-	PROVISION
9	-	-	-	PROVISION
10	-	-	-	PROVISION
11	-	-	-	PROVISION
12	-	-	-	PROVISION

P/P = PHOTOCCELL ON / PHOTOCCELL OFF
 P/T = PHOTOCCELL ON / TIMECLOCK OFF
 T/T = TIMECLOCK ON / TIMECLOCK OFF

DIVISION OF THE STATE ARCHITECT
 355 South Grand Avenue, Suite 2100
 Los Angeles, CA 90012
 ph: (213) 897-3995 fx: (213) 897-3159
 agency



BBP Architecture
 4611 Teller Avenue
 Newport Beach, CA 92660
 ph: 949.673.0000 fx: 949.732.3895



FBA Engineering
 Consulting Electrical Engineers
 4611 Teller Avenue, Suite A100
 Newport Beach, CA 92660
 ph: 949.673.0000 fx: 949.732.3895
 FBA Job Number: 212.227

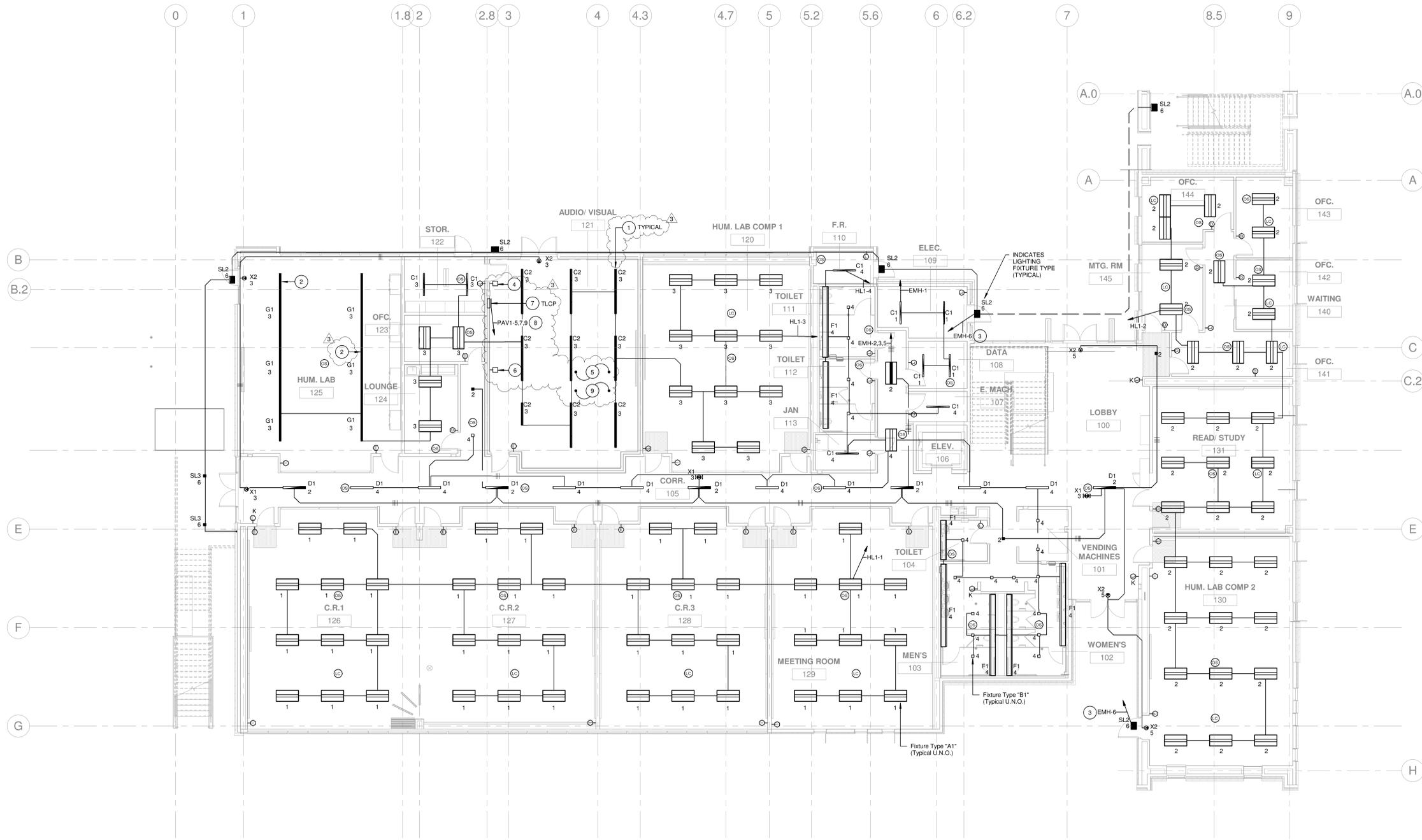
COMPTON COLLEGE
 INSTRUCTIONAL BUILDING No.2
 COMPTON COMMUNITY COLLEGE DISTRICT
 1111 E. ARTESIA BLVD. COMPTON, CA.
 owner

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 1 08/02/19 Addendum 1
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 3 09/12/19 Addendum 3

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drawing title:
 LIGHTING FIXTURE SCHEDULE & NOTES

drawing
 E0-0.3
 drawing of

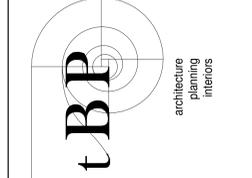


FIRST FLOOR LIGHTING PLAN
SCALE 1/8" = 1'-0" 1

KEY NOTES

- 1 CHAIN HANG LIGHT FIXTURE IN AUDIO/VISUAL 120 AT 12'-0" A.F.F. MOUNT LIGHTS ABOVE THE PIPE GRID.
- 2 CABLE SUSPEND BOTTOM OF FIXTURE AT +11'-0".
- 3 ROUTE VIA LIGHTING CONTROL RELAY PANEL "MLCR".
- 4 PROVIDE THEATRICAL DIMMING TOUCH SCREEN CONTROL STATION IN FLUSH IN WALL OUTLET BOX, +45°. VERIFY EXACT LOCATION WITH COLLEGE PRIOR TO ROUGH-IN.
- 5 PROVIDE THEATRICAL LIGHTING DMX DIMMING CONTROL SYSTEM IN AUDIO-VISUAL 121 IN ACCORDANCE WITH SPECIFICATION SECTION 26 5561. THE LIGHTING CONTROL SYSTEM SHALL INCLUDE DIMMING AND PROCESSING RACK ENCLOSURES, DIMMERS, RELAYS, POWER SUPPLIES, BREAKERS, TERMINALS AND/OR CONTROL ELECTRONICS. THEATRICAL LIGHTING FIXTURES TO BE PROVIDED BY COLLEGE.
- 6 PROVIDE THEATRICAL LIGHTING DATA PLUG IN STATION, +18" A.F.F. VERIFY EXACT LOCATION WITH COLLEGE PRIOR TO ROUGH-IN.
- 7 PROVIDE THEATRICAL DIMMING CONTROL RELAY PANEL, FLUSH IN WALL. VERIFY EXACT LOCATION WITH COLLEGE PRIOR TO ROUGH-IN.
- 8 PROVIDE #1, 1#8 GRD.-2" C.
- 9 PROVIDE SIX (6) 4-CIRCUIT (20A) DIGITAL BOXES CONNECTED TO OVERHEAD PIPE GRID SYSTEM. PROVIDE SIX (6) JUNCTION BOXES THROUGHOUT THE SPACE WITH 60/10/1 1/4" C. BACK TO TLCP AND CONNECT AS REQUIRED. VERIFY JUNCTION BOX LOCATIONS WITH COLLEGE PRIOR TO ROUGH-IN.

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
4611 Teller Avenue
Newport Beach, CA 92660
ph: 949.673.0300 fx: 949.732.3895
architect



consultant

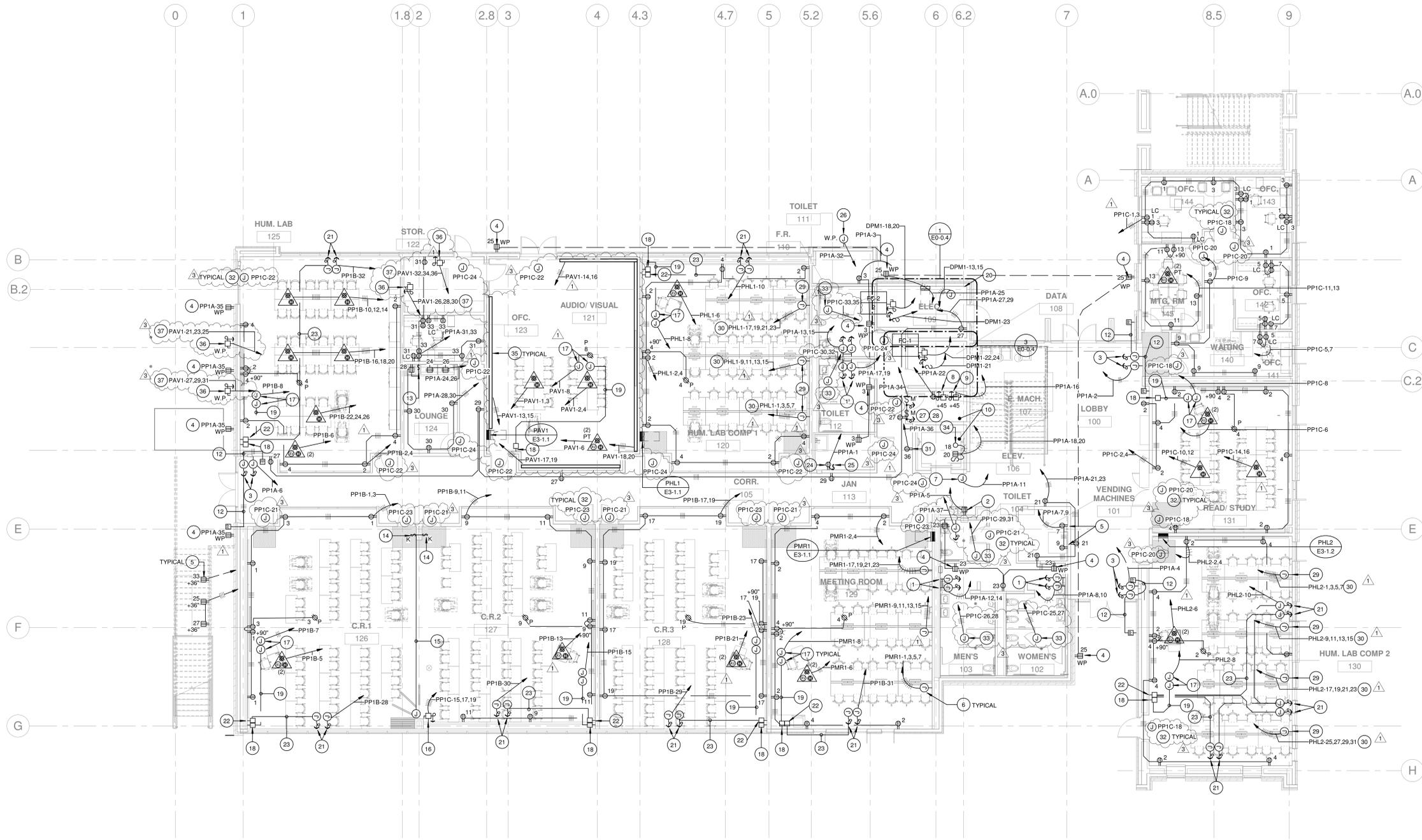
COMPTON COLLEGE
INSTRUCTIONAL BUILDING No.2
COMPTON COMMUNITY COLLEGE DISTRICT
1111 E. ARTESIA BLVD. COMPTON, CA.
owner

file name:	20998.00	
drawn by:	checked by:	
date:	04 / 08 / 2019	
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1	08/02/19	Addendum 1
2	09/04/19	Addendum 2
3	09/12/19	Addendum 3

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drawing title:
FIRST FLOOR LIGHTING PLAN

drawing
E1-1.1
drawing of



FIRST FLOOR POWER PLAN

SCALE 1/8" = 1'-0"

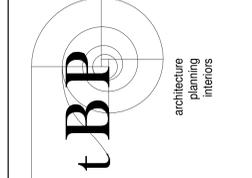
1

- 28 PROVIDE SEAL TITE FLEX CONNECTION TO ELECTRIFIED FURNITURE SYSTEM WIRING HARNESS. THE FURNITURE SYSTEM IS A 2 GENERAL PURPOSE + 2 ISOLATED CIRCUIT SYSTEM. VERIFY EXACT POINT OF CONNECTION LOCATION WITH THE FURNITURE SYSTEM DRAWINGS. INSTALL IN ACCORDANCE WITH THE FURNITURE SYSTEM MANUFACTURER'S WIRING REQUIREMENTS.
- 30 PROVIDE 4#10 (H), 1#10 (COMMON NEUTRAL), 1#10 (ISOLATED NEUTRAL), 1# 10 (COMMON GROUND) AND 1#10 (ISOLATED GROUND) IN 1 1/2" CONDUIT.
- 31 CONNECT TO PHONE CHARGING STATION. INSTALL IN ACCORDANCE WITH EQUIPMENT MANUFACTURER'S REQUIREMENTS.
- 32 PROVIDE JUNCTION BOX IN CEILING ABOVE DOOR WITH 120V CIRCUIT AND CONNECT TO ACCESS CONTROL DOOR POWER SUPPLIES. PROVIDE AT EACH DOOR. PROVIDE 4#12, 1#12 GRD. IN 3/4" C. BETWEEN JUNCTION BOXES AND HOMERUN. TYPICAL.
- 33 PROVIDE JUNCTION BOX WITH TWO (2) 120V CIRCUITS AT CEILING ABOVE ACCESS PANEL AND CONNECT TO ALL POWERED TOILET ROOM ACCESSORIES SUCH AS LAV AND FLUSH VALVE CONTROLS, PAPER TOWEL DISPENSER, ETC. REFER TO ARCHITECTURAL AND PLUMBING DRAWINGS FOR ALL ACCESSORIES.
- 34 PROVIDE ELEVATOR PIT LIGHT. METALLUX #2V72-LDS-4-FR50-UNV-L840-CD1-WL-SSL OR EQUAL BY LITHONIA, HE WILLIAMS. WALL MOUNT IN PIT IN LOCATION PER ELEVATOR SHOP DRAWINGS.
- 35 PROVIDE TWO COMPARTMENT SURFACE RACEWAY AT +18" A.F.F. WIREMOLD, LEGRAND #AL4320 SERIES OR EQUAL WITH 20 AMP, 125V DUPLEX GROUNDING TYPE RECEPTACLES 36 IN. OC. PROVIDE ELBOWS, COUPLINGS, COVERPLATES, ETC. FOR A COMPLETE INSTALLATION.
- 36 CONNECT TO KILN IN ACCORDANCE WITH THE EQUIPMENT MANUFACTURER'S REQUIREMENTS.
- 37 PROVIDE 3#4, 1#8 GRD-1 1/4" C.
- 16 CONNECT TO MOTOR OPERATED PARTITION IN ACCORDANCE WITH THE EQUIPMENT MANUFACTURERS REQUIREMENTS.
- 17 CONNECT TO MOTORIZED PROJECTION SCREEN IN ACCORDANCE WITH THE EQUIPMENT MANUFACTURERS REQUIREMENTS.
- 18 PROVIDE PROJECTION SCREEN CONTROLLER IN FLUSH IN WALL OUTLET BOX, +45°.
- 19 PROVIDE 3/4" C. WITH CONTROL WIRING IN ACCORDANCE WITH THE SCREEN MANUFACTURERS REQUIREMENTS.
- 20 PROVIDE 20" W X 30" H X 6" D TERMINAL CABINET, SURFACE MOUNTED, FOR HVAC CONTROL TRANSFORMERS. COORDINATE WITH HVAC CONTROLS CONTRACTOR.
- 21 CONNECT TO MOTOR OPERATED SHADES IN ACCORDANCE WITH THE EQUIPMENT MANUFACTURERS REQUIREMENTS.
- 22 PROVIDE SHADE CONTROLLER IN FLUSH IN WALL OUTLET BOX, +45°.
- 23 PROVIDE 3/4" C. WITH CONTROL WIRING IN ACCORDANCE WITH THE SHADE MANUFACTURERS REQUIREMENTS.
- 24 FOR CONNECTION TO GHW-1.
- 25 CONNECT TO CP-1 IN ACCORDANCE WITH THE MANUFACTURERS REQUIREMENTS.
- 26 CONNECT TO FIRE ALARM SPRINKLER BELL IN ACCORDANCE WITH THE MANUFACTURERS REQUIREMENTS. COORDINATE EXACT LOCATION AND HEIGHT PRIOR TO ROUGH-IN.
- 27 PROVIDE 120V POWER CONNECTION TO FIRE SMOKE DAMPERS. INSTALL IN ACCORDANCE WITH EQUIPMENT MANUFACTURERS REQUIREMENTS. REFER TO MECHANICAL DRAWINGS FOR ALL LOCATIONS AND QUANTITIES OF DAMPERS AND PROVIDE CONNECTIONS TO EACH. INCLUDE ALL COSTS IN BID TO COMPLY WITH THIS PROVISION.
- 28 ROUTE FIRE SMOKE DAMPER POWER THRU FIRE ALARM CONTROL MODULE.

KEY NOTES

- 1 CONNECT TO ELECTRIC HAND DRYERS IN ACCORDANCE WITH THE EQUIPMENT MANUFACTURERS REQUIREMENT.
- 2 CONNECT TO ELECTRIC WATER COOLER IN ACCORDANCE WITH THE EQUIPMENT MANUFACTURERS REQUIREMENTS.
- 3 CONNECT TO POWER ASSISTED DOOR IN ACCORDANCE WITH THE EQUIPMENT MANUFACTURERS REQUIREMENTS.
- 4 INSTALL GFCI TYPE RECEPTACLE IN FLUSH IN WALL LOCKING BOX, PASS AND SEYMOUR #4600 SERIES OR EQUAL BY COLE, +18°.
- 5 FOR CONNECTION TO VENDING MACHINES. INSTALL GFCI RECEPTACLES INSIDE ENCLOSURE.
- 6 FOR CONNECTION TO POWERED COMPUTER FURNITURE SYSTEM.
- 7 CONNECT TO ELEVATOR SMOKE GUARD SYSTEM IN ACCORDANCE WITH THE EQUIPMENT MANUFACTURERS REQUIREMENTS.
- 8 CONNECT TO ELEVATOR CONTROLLER IN ACCORDANCE WITH THE EQUIPMENT MANUFACTURERS REQUIREMENTS.
- 9 CONNECT TO ELEVATOR CAB LIGHTS, FANS, ETC. IN ACCORDANCE WITH THE ELEVATOR MANUFACTURERS REQUIREMENTS.
- 10 LOCATE ALL ELECTRICAL ITEMS IN THE ELEVATOR MACHINE ROOM AND PIT IN ACCORDANCE WITH THE ELEVATOR MANUFACTURERS SHOP DRAWINGS.
- 11 SEE SINGLE LINE DIAGRAM SHEET E0-0.2 FOR FEEDER REQUIREMENTS.
- 12 PROVIDE 3/4" C. WITH CONTROL WIRING IN ACCORDANCE WITH THE DOOR MANUFACTURERS REQUIREMENTS.
- 13 ENGRAVE SWITCH COVERPLATE TO READ: "DISPOSAL"
- 14 ENGRAVE SWITCH COVERPLATE TO READ: "PARTITION"
- 15 PROVIDE 3/4" C. WITH CONTROL WIRING IN ACCORDANCE WITH THE PARTITION MANUFACTURERS REQUIREMENTS.

DIVISION OF THE STATE ARCHITECT
355 South Grand Avenue, Suite 2100
Los Angeles, CA 90012
ph: (213) 897-3995 fx: (213) 897-3159
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IBP/Architecture
4611 Teller Avenue
Newport Beach, CA 92660
ph: 949.673.0000 fx: 949.732.3895
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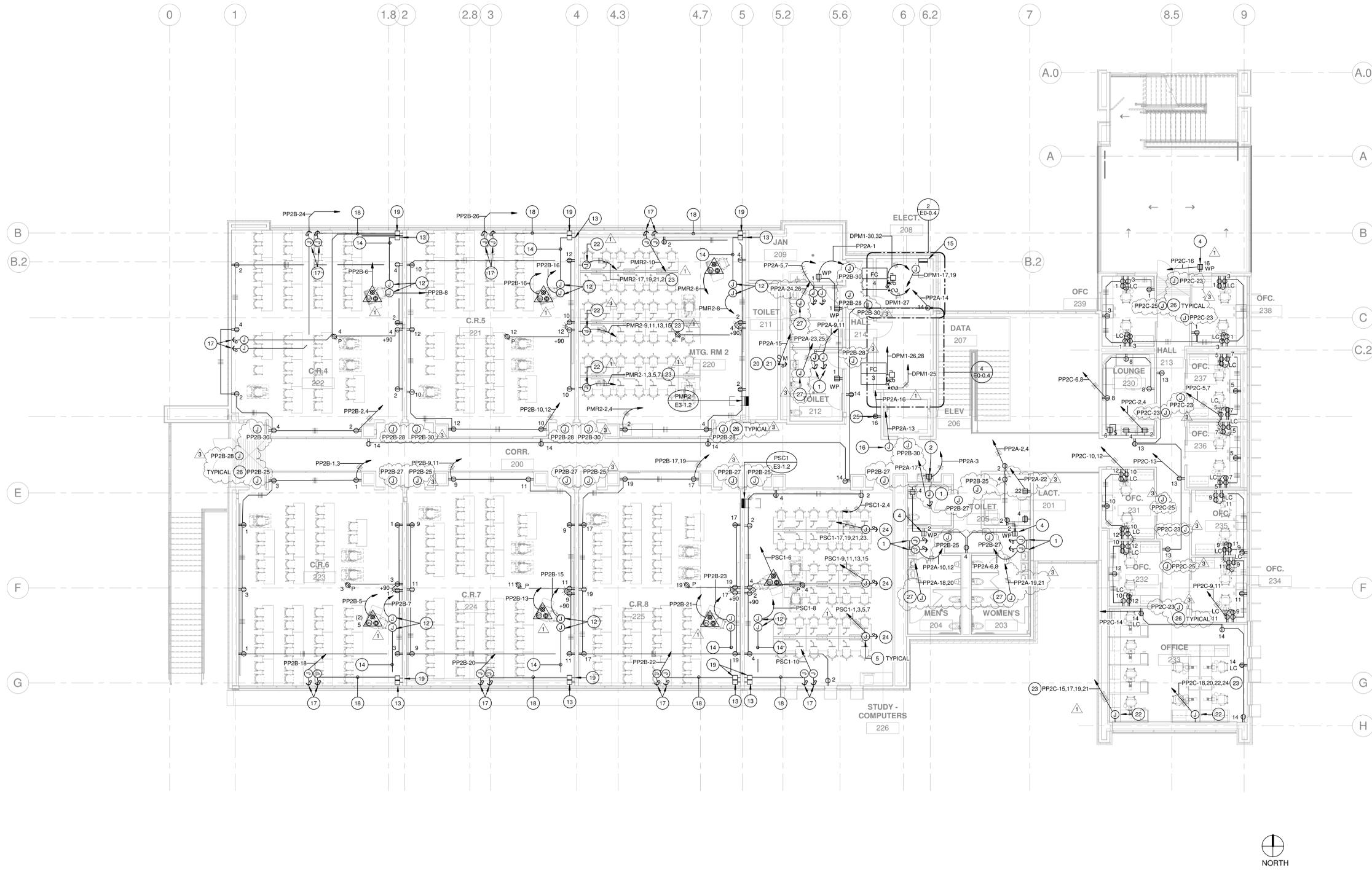


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COMPTON COMMUNITY COLLEGE DISTRICT
1111 E. ARTESIA BLVD. COMPTON, CA.
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IBP project number: 20998.00
file name:
drawn by: checked by:
date: 04 / 08 / 2019
rev: date: description:
1 08/02/19 Addendum 1
2 09/04/19 Addendum 2
3 09/12/19 Addendum 3
drawing title: **FIRST FLOOR POWER PLAN**
drawing **E2-1.1** of

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SECOND FLOOR POWER PLAN 1
SCALE 1/8" = 1'-0"

26 PROVIDE JUNCTION BOX IN CEILING ABOVE DOOR WITH 120V CIRCUIT AND CONNECT TO ACCESS CONTROL DOOR POWER SUPPLIES. PROVIDE AT EACH DOOR. PROVIDE 4#12, 1#12 GRD. IN 3/4" C. BETWEEN JUNCTION BOXES AND HOMERUN. TYPICAL.

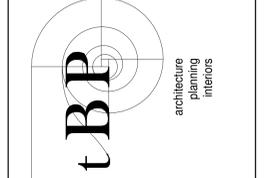
27 PROVIDE JUNCTION BOX WITH TWO (2) 120V CIRCUITS AT CEILING ABOVE ACCESS PANEL AND CONNECT TO ALL POWERED TOILET ROOM ACCESSORIES SUCH AS LAV AND FLUSH VALVE CONTROLS, PAPER TOWEL DISPENSERS, ETC. REFER TO ARCHITECTURAL AND PLUMBING DRAWINGS FOR ALL ACCESSORIES.

- 16 CONNECT AREA OF REFUGE TWO WAY COMMUNICATION DEVICE IN ACCORDANCE WITH THE EQUIPMENT MANUFACTURERS REQUIREMENTS.
- 17 CONNECT TO MOTOR OPERATED SHADES IN ACCORDANCE WITH THE EQUIPMENT MANUFACTURERS REQUIREMENTS.
- 18 PROVIDE 1/4" C. WITH CONTROL WIRING IN ACCORDANCE WITH THE SHADE MANUFACTURERS REQUIREMENTS.
- 19 PROVIDE SHADE CONTROLLER IN FLUSH IN WALL OUTLET BOX, +45".
- 20 PROVIDE 120V POWER CONNECTION TO FIRE SMOKE DAMPERS. INSTALL IN ACCORDANCE WITH EQUIPMENT MANUFACTURERS REQUIREMENTS. REFER TO MECHANICAL DRAWINGS FOR ALL LOCATIONS AND QUANTITIES OF DAMPERS AND PROVIDE CONNECTIONS TO EACH. INCLUDE ALL COSTS IN BID TO COMPLY WITH THIS PROVISION.
- 21 ROUTE FIRE SMOKE DAMPER POWER THRU FIRE ALARM CONTROL MODULE.
- 22 PROVIDE SEAL-TITE FLEX CONNECTION TO ELECTRIFIED FURNITURE SYSTEM WIRING HARNESS. THE FURNITURE SYSTEM IS A "2 GENERAL PURPOSE + 2 ISOLATED CIRCUIT" SYSTEM. VERIFY EXACT POINT OF CONNECTION LOCATION WITH THE FURNITURE SYSTEM DRAWINGS. INSTALL IN ACCORDANCE WITH THE FURNITURE SYSTEM MANUFACTURER'S WIRING REQUIREMENTS.
- 23 PROVIDE 4#10 (H.), 1#10 (COMMON NEUTRAL), 1#10 (ISOLATED NEUTRAL), 1# 10 (COMMON GROUND) AND 1#10 (ISOLATED GROUND) IN 1/2" CONDUIT.
- 24 PROVIDE FLUSH IN FLOOR COMBINATION POWER/DATA FLOOR POKE THROUGH DEVICE WITH FURNITURE FEED COVER. FURNITURE FEED COVER SHALL HAVE MINIMUM 1 1/2" CONNECTION FOR COMPUTER DATA/VOICE NETWORK CABLING AND 1" CONDUIT FOR POWER FEED CONNECTION. INSTALL POKE-THROUGH IN LOCATION PER THE FURNITURE SYSTEM DRAWINGS.
- 25 CONNECT TO PHONE CHARGING STATION. INSTALL IN ACCORDANCE WITH EQUIPMENT MANUFACTURERS REQUIREMENTS.

KEY NOTES

- 1 CONNECT TO ELECTRIC HAND DRYERS IN ACCORDANCE WITH THE EQUIPMENT MANUFACTURERS REQUIREMENT.
- 2 CONNECT TO ELECTRIC WATER COOLER IN ACCORDANCE WITH THE EQUIPMENT MANUFACTURERS REQUIREMENTS.
- 3 CONNECT TO POWER ASSISTED DOOR IN ACCORDANCE WITH THE EQUIPMENT MANUFACTURERS REQUIREMENTS.
- 4 INSTALL GFCI TYPE RECEPTACLE IN FLUSH IN WALL LOCKING BOX, PASS AND SEYMOUR #4600 SERIES OR EQUAL BY COLE, +18".
- 5 FOR CONNECTION TO POWERED COMPUTER FURNITURE SYSTEM.
- 6 SEE SINGLE LINE DIAGRAM SHEET E0-2 FOR FEEDER REQUIREMENTS.
- 7 PROVIDE 3/4" C. WITH CONTROL WIRING IN ACCORDANCE WITH THE DOOR MANUFACTURERS REQUIREMENTS.
- 8 ENGRAVE SWITCH COVERPLATE TO READ: "DISPOSAL"
- 9 ENGRAVE SWITCH COVERPLATE TO READ: "PARTITION"
- 10 PROVIDE 3/4" C. WITH CONTROL WIRING IN ACCORDANCE WITH THE PARTITION MANUFACTURERS REQUIREMENTS.
- 11 CONNECT TO MOTOR OPERATED PARTITION IN ACCORDANCE WITH THE EQUIPMENT MANUFACTURERS REQUIREMENTS.
- 12 CONNECT TO MOTORIZED PROJECTION SCREEN IN ACCORDANCE WITH THE SCREEN MANUFACTURERS REQUIREMENTS.
- 13 PROVIDE PROJECTION SCREEN CONTROLLER IN FLUSH IN WALL OUTLET BOX, +45".
- 14 PROVIDE 3/4" C. WITH CONTROL WIRING IN ACCORDANCE WITH THE SCREEN MANUFACTURERS REQUIREMENTS.
- 15 PROVIDE 20"W X 30"H X 6"D TERMINAL CABINET, SURFACE MOUNTED, FOR HVAC CONTROL TRANSFORMERS. COORDINATE WITH HVAC CONTROLS CONTRACTOR.

DIVISION OF THE STATE ARCHITECT
355 South Grand Avenue, Suite 2100
Los Angeles, CA 90012
ph: (213) 897-3995 fx: (213) 897-3159
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IBP/Architecture
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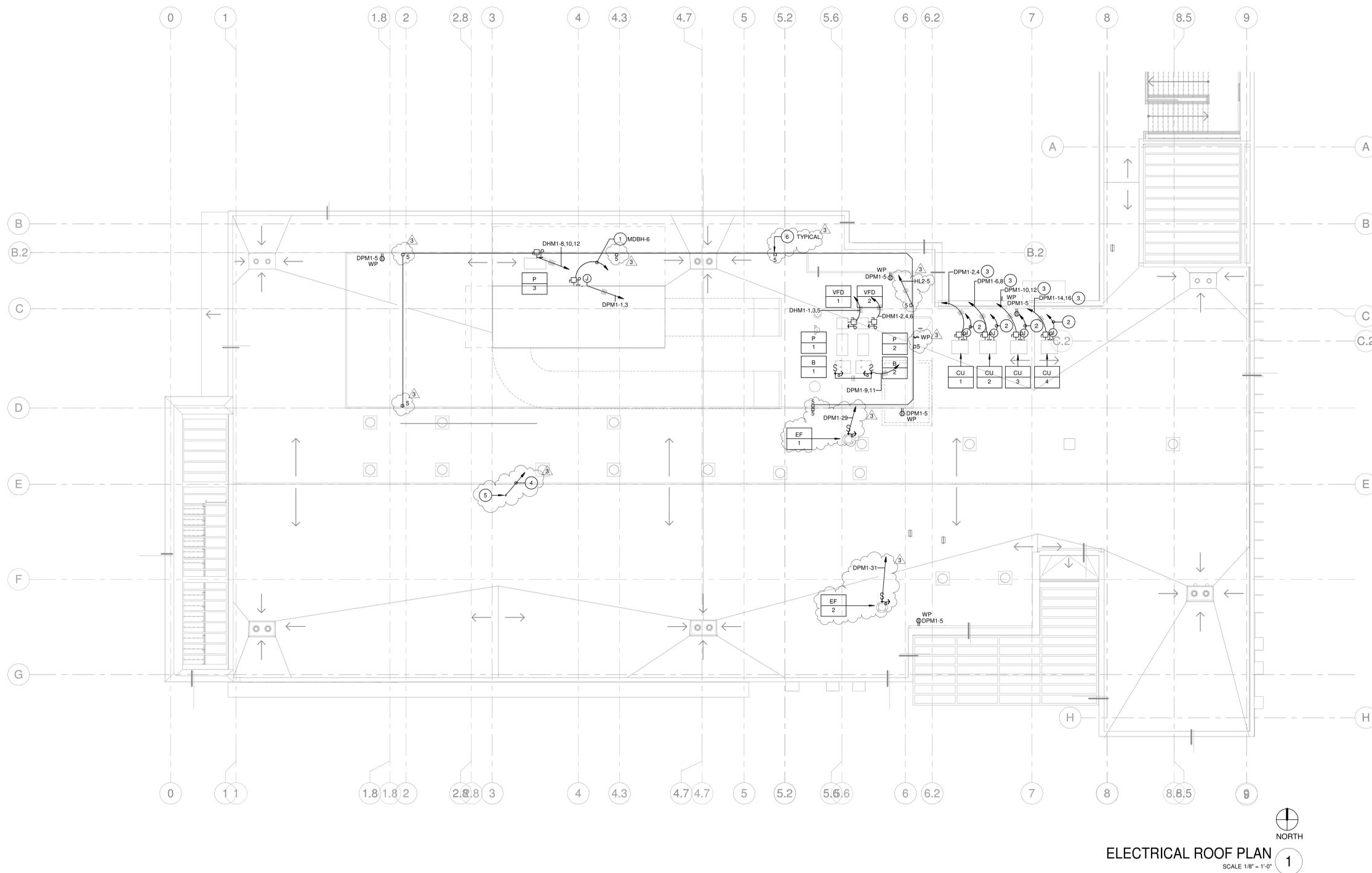


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COMPTON COLLEGE
INSTRUCTIONAL BUILDING No.2
COMPTON COMMUNITY COLLEGE DISTRICT
1111 E. ARTESIA BLVD. COMPTON, CA.
owner

IBP project number: 20998.00
file name:
drawn by: checked by:
date: 04 / 08 / 2019
rev: date: description:
1 08/02/19 Addendum 1
2 09/04/19 Addendum 2
3 09/12/19 Addendum 3
drawing title:
SECOND FLOOR POWER PLAN
drawing
E2-2.1
drawing of

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ELECTRICAL ROOF PLAN

SCALE 1/8" = 1'-0"



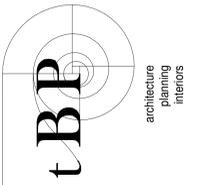
ELECTRICAL PERFORMANCE NOTES

1. ALL ELECTRICAL EQUIPMENT, DEVICES, ETC LOCATED OUTDOORS SHALL BE WEATHERPROOF.
2. REFER TO MECHANICAL DRAWINGS FOR EXACT LOCATIONS OF ALL EQUIPMENT.
3. ALL CONDUIT WORK SHALL BE CONCEALED IN SECOND FLOOR CEILING SPACE BELOW. PROVIDE CONNECTIONS AT EQUIPMENT POWER AND CONTROL POINTS OF CONNECTION IN ACCORDANCE WITH THE HVAC EQUIPMENT SHOP DRAWINGS. CONDUIT PENETRATIONS THROUGH ROOF SHALL BE IN ACCORDANCE WITH 147.01 AND 750.15.
4. HVAC CONTROLS ARE TYPICALLY PERFORMANCE BASED. REFER TO MECHANICAL AND PLUMBING DRAWINGS AND SPECIFICATIONS FOR ALL REQUIRED HVAC CONTROLS CONDUIT AND CONNECTIONS. REQUIRED 120V. POWER CONNECTIONS AND PROVIDE IN ACCORDANCE WITH THE MECHANICAL AND PLUMBING DRAWINGS AND SPECIFICATIONS. INCLUDE ALL COST IN BID TO COMPLY WITH THIS PROVISION.

KEY NOTES

- 1 SEE SINGLE LINE DIAGRAM FOR FEEDER REQUIREMENTS.
- 2 PROVIDE 3/4" WITH CONTROL WIRING TO INDOOR FAN COIL UNIT.
- 3 PROVIDE 2#10, 1#10 GRD. - 3/4"
- 4 PROVIDE TWO (2) 3" O. DOWN TO FIRST FLOOR ELECTRICAL ROOM FOR FUTURE PHOTOVOLTAIC.
- 5 PROVIDE WATERTIGHT PENETRATIONS THROUGH ROOF, STUB, CAP AND MARK.
- 6 PROVIDE LIGHT FIXTURE MOUNTED TO MECHANICAL SCREEN WALL, FAILSAFE #B95-LD4-20W-40-OPL-UNV-EDDI OR EQUAL BY LITHONIA. TYPICAL.

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
4611 Teller Avenue
Newport Beach, CA 92660
ph: 949.673.0300 fx: 949.732.3895



FBAA Engineering
Consulting Electrical Engineers
10000 Wilshire Blvd, Suite 1100
Beverly Hills, CA 90210
Tel: 310.277.1100
Fax: 310.277.1101
FBA Job Number: 212.227

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1 08/02/19 Addendum 1

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drawing title:
ELECTRICAL ROOF PLAN

drawing

E2-2.2

drawing of

Branch Panel: HL1												INSTRUCTIONAL BUILDING NO. 2																							
Location: Space 397 Supply From: T1 Mounting: Surface				Volts: 480/277 Wye Phases: 3 Wires: 4 Isolated Ground Bus:				A.I.C. Rating: Mains Type: CB Mains Rating: 225 A MCB Rating: 100 A				Location: Space 124 Supply From: TM1 Mounting: Surface				Volts: 480/277 Wye Phases: 3 Wires: 4 Isolated Ground Bus:				A.I.C. Rating: Mains Type: CB Mains Rating: 225 A MCB Rating: 100 A															
CKT	Circuit Description	Quan	Trip	Pole	A	B	C	Pole	Trip	Quan	Circuit Description	CKT	Circuit Description	Quan	Trip	Pole	A	B	C	Pole	Trip	Quan	Circuit Description												
1	Lighting 1st Floor	43	20 A	1	2752...	2176...				1	20 A	34	Lighting 1st Floor	2	1	20 A	3	941 VA	941 VA			3	20 A	1	P-2 - 2 HP										
3	Lighting 1st Floor	3	20 A	1		2253...	921 VA			1	20 A	37	Lighting 1st Floor	4	3							1	20 A	1	P-2 - 2 HP										
5	Lighting Site	11	20 A	1			1815...	1320...		1	20 A	8	Lighting Site	6	5							3	20 A	1	P-3 - 7.5 HP										
7	Lighting Site	10	20 A	1	1650...	1320...				1	20 A	8	Lighting Site	7	Spare	--	--	0 VA	3043 VA			9	20 A	1	P-3 - 7.5 HP										
9	Spare	--	20 A	1		0 VA	2244...			1	30 A	1	INVERTER EMH	10	Spare	--	--	0 VA	3043 VA			10	9	B-1											
11	Spare	--	20 A	1		0 VA	0 VA			1	20 A	--	Spare	12	11	Spare	--	--	0 VA	3043 VA			12	11	B-2										
13	Spare	--	20 A	1	0 VA	0 VA				1	20 A	--	Spare	14	13	Spare	--	--	0 VA	0 VA			14	13	1ST FLOOR HVAC PANEL										
15	Spare	--	20 A	1		0 VA	0 VA			1	20 A	--	Spare	16	15	Spare	--	--	0 VA	0 VA			16	15	1ST FLOOR HVAC PANEL										
17	Spare	--	20 A	1		0 VA	0 VA			1	20 A	--	Spare	18	17	Spare	--	--	0 VA	0 VA			18	17	2ND FLOOR HVAC PANEL										
19	Spare	--	20 A	1	0 VA	0 VA				1	20 A	--	Spare	20	19	Provision	--	--	0 VA	0 VA			20	19	2ND FLOOR HVAC PANEL										
21	Spare	--	20 A	1		0 VA	0 VA			1	20 A	--	Spare	22	21	Provision	--	--	0 VA	0 VA			22	21	CP-1										
23	Spare	--	20 A	1		0 VA	0 VA			1	20 A	--	Spare	24	23	Provision	--	--	0 VA	0 VA			24	23	CP-2										
25	Spare	--	20 A	1	0 VA	4608...				3	60 A	1	HL2	26	25	Provision	--	--	0 VA	0 VA			26	25	CP-3										
27	Spare	--	20 A	1		0 VA	2990...			--	--	--	--	28	27	Provision	--	--	0 VA	0 VA			28	27	CP-4										
29	Spare	--	20 A	1		0 VA	379 VA			--	--	--	--	30	29	Provision	--	--	0 VA	0 VA			30	29	EF-1 ROOF										
31	Provision	--	20 A	1		0 VA	0 VA			--	--	--	--	32	31	Provision	--	--	0 VA	0 VA			32	31	EF-2 ROOF										
33	Provision	--	20 A	1		0 VA	0 VA			--	--	--	--	34	33	Provision	--	--	0 VA	0 VA			34	33	Spare										
35	Provision	--	20 A	1		0 VA	0 VA			--	--	--	--	36	35	Provision	--	--	0 VA	0 VA			36	35	Spare										
37	Provision	--	20 A	1	0 VA	0 VA				--	--	--	--	38	37	Provision	--	--	0 VA	15365...			38	37	Spare										
39	Provision	--	20 A	1		0 VA	0 VA			--	--	--	--	40	39	Provision	--	--	0 VA	12472...			40	39	Spare										
41	Provision	--	20 A	1		0 VA	0 VA			--	--	--	--	42	41	Provision	--	--	0 VA	11404 VA			42	41	Spare										
Total Load: 9988 VA Total Amps: 39 A												Total Load: 20289 VA Total Amps: 74 A												Total Load: 15365 VA Total Amps: 129 A											

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals
Lighting	1811 VA	100.00%	1811 VA	Total Conn. Load: 19549 VA
Other	1585 VA	100.00%	1585 VA	Total Est. Demand: 19549 VA
				Total Conn.: 24 A
				Total Est. Demand: 24 A

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals
Motor	3800 VA	100.00%	3800 VA	Total Conn. Load: 53983 VA
Other	4760 VA	100.00%	4760 VA	Total Est. Demand: 53983 VA
Power	45235 VA	100.00%	45235 VA	Total Conn.: 65 A
Receptacle	900 VA	100.00%	900 VA	Total Est. Demand: 65 A

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals
Motor	3800 VA	100.00%	3800 VA	Total Conn. Load: 39226 VA
Other	4760 VA	100.00%	4760 VA	Total Est. Demand: 39226 VA
Power	30460 VA	100.00%	30460 VA	Total Conn.: 109 A
Receptacle	900 VA	100.00%	900 VA	Total Est. Demand: 109 A

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals
Motor	3800 VA	100.00%	3800 VA	Total Conn. Load: 39226 VA
Other	4760 VA	100.00%	4760 VA	Total Est. Demand: 39226 VA
Power	30460 VA	100.00%	30460 VA	Total Conn.: 109 A
Receptacle	900 VA	100.00%	900 VA	Total Est. Demand: 109 A

Switchboard: DPP1												INSTRUCTIONAL BUILDING NO. 2																							
Location: Space 397 Supply From: T1 Mounting: SURFACE Enclosure:				Volts: 120/208 Wye Phases: 3 Wires: 4				A.I.C. Rating: Mains Type: CB Mains Rating: 800 A MCB Rating:				Location: Space 397 Supply From: DPP1 Mounting: Recessed				Volts: 120/208 Wye Phases: 3 Wires: 4				A.I.C. Rating: Mains Type: CB Mains Rating: 225 A MCB Rating: 100 A															
CKT	Circuit Description	Quan	Trip	Pole	A	B	C	Pole	Trip	Quan	Circuit Description	CKT	Circuit Description	Quan	Trip	Pole	A	B	C	Pole	Trip	Quan	Circuit Description												
1	PP1A	3	400 A	20 A	34320 VA					1	20 A	1	POWER ASSISTED DOOR	2	1	20 A	1	720 VA	720 VA			4	20 A	4	HUM LAB RECEPTACLES										
2	PP1B	3	400 A	20 A	26300 VA					1	20 A	1	POWER ASSISTED DOOR	4	3	20 A	1	540 VA	900 VA			1	20 A	5	HUM LAB RECEPTACLES										
3	PP1C	3	400 A	20 A	19980 VA					1	20 A	1	POWER ASSISTED DOOR	6	5	20 A	1	500 VA	500 VA			1	20 A	1	HUM LAB LECTERN										
4	PAV1	3	400 A	20 A	32000 VA					1	20 A	1	WOMENS 102 HAND DRYER	8	7	20 A	1	800 VA	800 VA			1	20 A	1	HUM LAB PROJ. SCREEN										
5	PHL1	3	400 A	20 A	22040 VA					1	20 A	1	WOMENS 102 HAND DRYER	10	9	20 A	1	900 VA	1440...			1	20 A	2	HUM LAB FLOOR BOX										
6	PMR1	3	400 A	20 A	22120 VA					1	20 A	1	MENS 103 HAND DRYER	12	11	20 A	1	720 VA	1440...			1	20 A	2	HUM LAB FLOOR BOX										
7	PHL2	3	400 A	20 A	30200 VA					1	20 A	1	MENS 103 HAND DRYER	14	13	20 A	1	500 VA	1440...			1	20 A	2	HUM LAB FLOOR BOX										
8	Provision	--	--	--	0 VA					1	20 A	1	ELEV. CAB LITS FAN, ETC.	16	15	20 A	1	800 VA	1440...			1	20 A	2	HUM LAB FLOOR BOX										
9	Provision	--	--	--	0 VA					1	20 A	1	ELEV. PIT LIGHT	18	17	20 A	1	900 VA	1440...			1	20 A	2	HUM LAB FLOOR BOX										
10	Provision	--	--	--	0 VA					1	20 A	1	ELEV. MACH RM. RECEPTACLE	20	19	20 A	1	900 VA	1440...			1	20 A	2	HUM LAB FLOOR BOX										
11	Provision	--	--	--	0 VA					3	20 A	1	RECEPTACLES CONV.	22	21	20 A	1	500 VA	720 VA			1	20 A	1	HUM LAB FLOOR BOX										
12	Provision	--	--	--	0 VA					4	20 A	1	RECEPTACLES EXTERIOR	24	23	20 A	1	500 VA	720 VA			1	20 A	1	HUM LAB FLOOR BOX										
13	Provision	--	--	--	0 VA					4	20 A	1	RECEPTACLES LOUNGE COUNTER	26	25	20 A	1	500 VA	720 VA			1	20 A	1	HUM LAB FLOOR BOX										
14	Provision	--	--	--	0 VA					4	20 A	1	RECEPTACLES LOUNGE COUNTER	28	27	20 A	1	500 VA	720 VA			1	20 A	1	Motor Operated Shade C.R.1 126										
15	Provision	--	--	--	0 VA					4	20 A	1	RECEPTACLES LOUNGE COUNTER	30	29	20 A	1	500 VA	720 VA			1	20 A	1	Motor Operated Shade C.R.2 127										
16	Provision	--	--	--	0 VA					4	20 A	1	RECEPTACLES LOUNGE RECEPTS	32	31	20 A	1	500 VA	720 VA			1	20 A	1	Motor Operated Shade HUM. LAB-1 125-1										
17	Provision	--	--	--	0 VA					4	20 A	1	RECEPTACLES LOUNGE RECEPTS	34	33	20 A	1	500 VA	720 VA			1	20 A	1	Spare										
18	Provision	--	--	--	0 VA					4	20 A	1	RECEPTACLES LOUNGE RECEPTS	36	35	20 A	1	500 VA	720 VA			1	20 A	1	Spare										
19	Provision	--	--	--	0 VA					4	20 A	1	RECEPTACLES LOUNGE RECEPTS	38	37	20 A	1	500 VA	720 VA			1	20 A	1	Spare										
20	Provision	--	--	--	0 VA					4	20 A	1	RECEPTACLES LOUNGE RECEPTS	40	39	20 A	1	500 VA	720 VA			1	20 A	1	Spare										
Total Conn. Load: 168880 VA Total Amps: 469 A												Total Load: 13400 VA Total Amps: 113 A												Total Load: 9540 VA Total Amps: 80 A											

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals
Lighting	100 VA	100.00%	100 VA	Total Conn. Load: 26300 VA
Motor	100 VA	100.00%	100 VA	Total Est. Demand: 21050 VA
Other	32000 VA	100.00%	32000 VA	Total Conn.: 73 A
Power	79380 VA	100.00%	79380 VA	Total Est. Demand: 58 A
Receptacle	57320 VA	58.72%	33660 VA	

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals
Lighting	100 VA	100.00%	100 VA	Total Conn. Load: 26300 VA
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Branch Panel: PMR1												Branch Panel: PHL2												Branch Panel: HL2																				
Location: MEETING ROOM-1 129-1 Supply From: DPP1 Mounting: FLUSH												Location: HUM. LAB COMP 2 130 Supply From: DPP1 Mounting: FLUSH												Location: Space 124 Supply From: HL1 Mounting: Surface																				
Volts: 120/208 Wye Phases: 3 Wires: 4 Isolated Ground Bus:												Volts: 120/208 Wye Phases: 3 Wires: 4 Isolated Ground Bus:												Volts: 480/277 Wye Phases: 3 Wires: 4 Isolated Ground Bus:																				
A.I.C. Rating: Mains Type: CB Mains Rating: 225 A MCB Rating: 100 A												A.I.C. Rating: Mains Type: CB Mains Rating: 225 A MCB Rating: 100 A												A.I.C. Rating: Mains Type: CB Mains Rating: 225 A MCB Rating: 100 A																				
CKT	Circuit Description	Quan	Trip	Pole	A	B	C	Pole	Trip	Quan	Circuit Description	CKT	CKT	Circuit Description	Quan	Trip	Pole	A	B	C	Pole	Trip	Quan	Circuit Description	CKT	CKT	Circuit Description	Quan	Trip	Pole	A	B	C	Pole	Trip	Quan	Circuit Description	CKT						
1	MEETING ROOM COMPUTERS	1	20 A	1	1600...	900 VA		1	20 A	5	MEETING ROOM RECEPTACLES	2	1	HUM LAB COMPUTERS	1	20 A	1	1600...	900 VA		1	20 A	5	HUM LAB COMP 2 RECEPTACLES	2	1	Lighting 2nd Floor	45	20 A	1	2880...	1728...		1	20 A	27	Lighting 2nd Floor	2						
3	MEETING ROOM COMPUTERS	1	20 A	1		1600...	720 VA		1	20 A	4	MEETING ROOM RECEPTACLES	4	3	HUM LAB COMPUTERS	1	20 A	1		1600...	900 VA		1	20 A	5	HUM LAB COMP 2 RECEPTACLES	4	3	Lighting 2nd Floor	33	20 A	1		2112...	1021...		1	20 A	42	Lighting 2nd Floor	4			
5	MEETING ROOM COMPUTERS	1	20 A	1				1600...	500 VA	1	20 A	1	MEETING ROOM LECTERN	6	5	HUM LAB COMPUTERS	1	20 A	1				1600...	500 VA	1	20 A	1	HUM LAB COMP 2 LECTERN	8	20 A	1				160 VA	219 VA		1	20 A	3	Lighting 2nd Floor Corridor	6		
7	MEETING ROOM COMPUTERS	1	20 A	1	1600...	800 VA				1	20 A	1	MEETING ROOM PROJ. SCREEN	8	7	HUM LAB COMPUTERS	1	20 A	1	1600...	800 VA			1	20 A	3	Motor Operated Shade HUM. LAB COMP 2 130	8	7	Spare			0 VA	0 VA				1	20 A	1	Spare	8		
9	MEETING ROOM COMPUTERS	1	20 A	1		1600...	0 VA			1	20 A	1	Spare	10	9	HUM LAB COMPUTERS	1	20 A	1		1600...	1500...			1	20 A	1	Spare				0 VA	0 VA				1	20 A	1	Spare	10			
11	MEETING ROOM COMPUTERS	1	20 A	1			1600...	0 VA		1	20 A	1	Spare	12	11	HUM LAB COMPUTERS	1	20 A	1		1600...	0 VA		1	20 A	1	Spare				0 VA	0 VA		0 VA	0 VA		1	20 A	1	Spare	12			
13	MEETING ROOM COMPUTERS	1	20 A	1	1600...	0 VA				1	20 A	1	Spare	14	13	HUM LAB COMPUTERS	1	20 A	1	1600...	0 VA			1	20 A	1	Spare				0 VA	0 VA		0 VA	0 VA		1	20 A	1	Spare	14			
15	MEETING ROOM COMPUTERS	1	20 A	1		1600...	0 VA			1	20 A	1	Spare	16	15	HUM LAB COMPUTERS	1	20 A	1		1600...	0 VA		1	20 A	1	Spare				0 VA	0 VA		0 VA	0 VA		1	20 A	1	Spare	16			
17	MEETING ROOM COMPUTERS	1	20 A	1			1600...	0 VA		1	20 A	1	Spare	18	17	HUM LAB COMPUTERS	1	20 A	1		1600...	0 VA		1	20 A	1	Spare				0 VA	0 VA		0 VA	0 VA		1	20 A	1	Spare	18			
19	MEETING ROOM COMPUTERS	1	20 A	1	1600...	0 VA				1	20 A	1	Spare	20	19	HUM LAB COMPUTERS	1	20 A	1	1600...	0 VA			1	20 A	1	Spare				0 VA	0 VA		0 VA	0 VA		1	20 A	1	Spare	20			
21	MEETING ROOM COMPUTERS	1	20 A	1		1600...	0 VA			1	20 A	1	Spare	22	21	HUM LAB COMPUTERS	1	20 A	1		1600...	0 VA		1	20 A	1	Spare				0 VA	0 VA		0 VA	0 VA		1	20 A	1	Spare	22			
23	MEETING ROOM COMPUTERS	1	20 A	1			1600...	0 VA		1	20 A	1	Spare	24	23	HUM LAB COMPUTERS	1	20 A	1		1600...	0 VA		1	20 A	1	Spare				0 VA	0 VA		0 VA	0 VA		1	20 A	1	Spare	24			
25	Provision	--	--	--	0 VA	0 VA				--	--	Provision	26	25	HUM LAB COMPUTERS	1	20 A	1	1600...	0 VA			--	--	Provision	26	25	Spare	--	20 A	1	0 VA	0 VA		0 VA	0 VA		1	20 A	1	Spare	26		
27	Provision	--	--	--	0 VA	0 VA		0 VA	0 VA	--	--	Provision	28	27	HUM LAB COMPUTERS	1	20 A	1		1600...	0 VA			--	--	Provision	28	27	Spare	--	20 A	1		0 VA	0 VA		0 VA	0 VA		1	20 A	1	Spare	28
29	Provision	--	--	--	0 VA	0 VA		0 VA	0 VA	--	--	Provision	30	29	HUM LAB COMPUTERS	1	20 A	1		1600...	0 VA			--	--	Provision	30	29	Spare	--	20 A	1		0 VA	0 VA		0 VA	0 VA		1	20 A	1	Spare	30
31	Provision	--	--	--	0 VA	0 VA		0 VA	0 VA	--	--	Provision	32	31	HUM LAB COMPUTERS	1	20 A	1	1600...	0 VA			--	--	Provision	32	31	Spare	--	20 A	1	0 VA	0 VA		0 VA	0 VA		1	20 A	1	Spare	32		
33	Provision	--	--	--	0 VA	0 VA		0 VA	0 VA	--	--	Provision	34	33	Provision	--	--	--	0 VA	0 VA			--	--	Provision	34	33	Spare	--	20 A	1	0 VA	0 VA		0 VA	0 VA		1	20 A	1	Spare	34		
35	Provision	--	--	--	0 VA	0 VA		0 VA	0 VA	--	--	Provision	36	35	Provision	--	--	--	0 VA	0 VA			--	--	Provision	36	35	Spare	--	20 A	1	0 VA	0 VA		0 VA	0 VA		1	20 A	1	Spare	36		
37	Provision	--	--	--	0 VA	0 VA		0 VA	0 VA	--	--	Provision	38	37	Provision	--	--	--	0 VA	0 VA			--	--	Provision	38	37	Spare	--	20 A	1	0 VA	0 VA		0 VA	0 VA		1	20 A	1	Spare	38		
39	Provision	--	--	--	0 VA	0 VA		0 VA	0 VA	--	--	Provision	40	39	Provision	--	--	--	0 VA	0 VA			--	--	Provision	40	39	Spare	--	20 A	1	0 VA	0 VA		0 VA	0 VA		1	20 A	1	Spare	40		
41	Provision	--	--	--	0 VA	0 VA		0 VA	0 VA	--	--	Provision	42	41	Provision	--	--	--	0 VA	0 VA			--	--	Provision	42	41	Spare	--	20 A	1	0 VA	0 VA		0 VA	0 VA		1	20 A	1	Spare	42		
Total Load: 8100 VA Total Amps: 68 A												Total Load: 11300 VA Total Amps: 97 A												Total Load: 4608 VA Total Amps: 18 A																				

Legend:

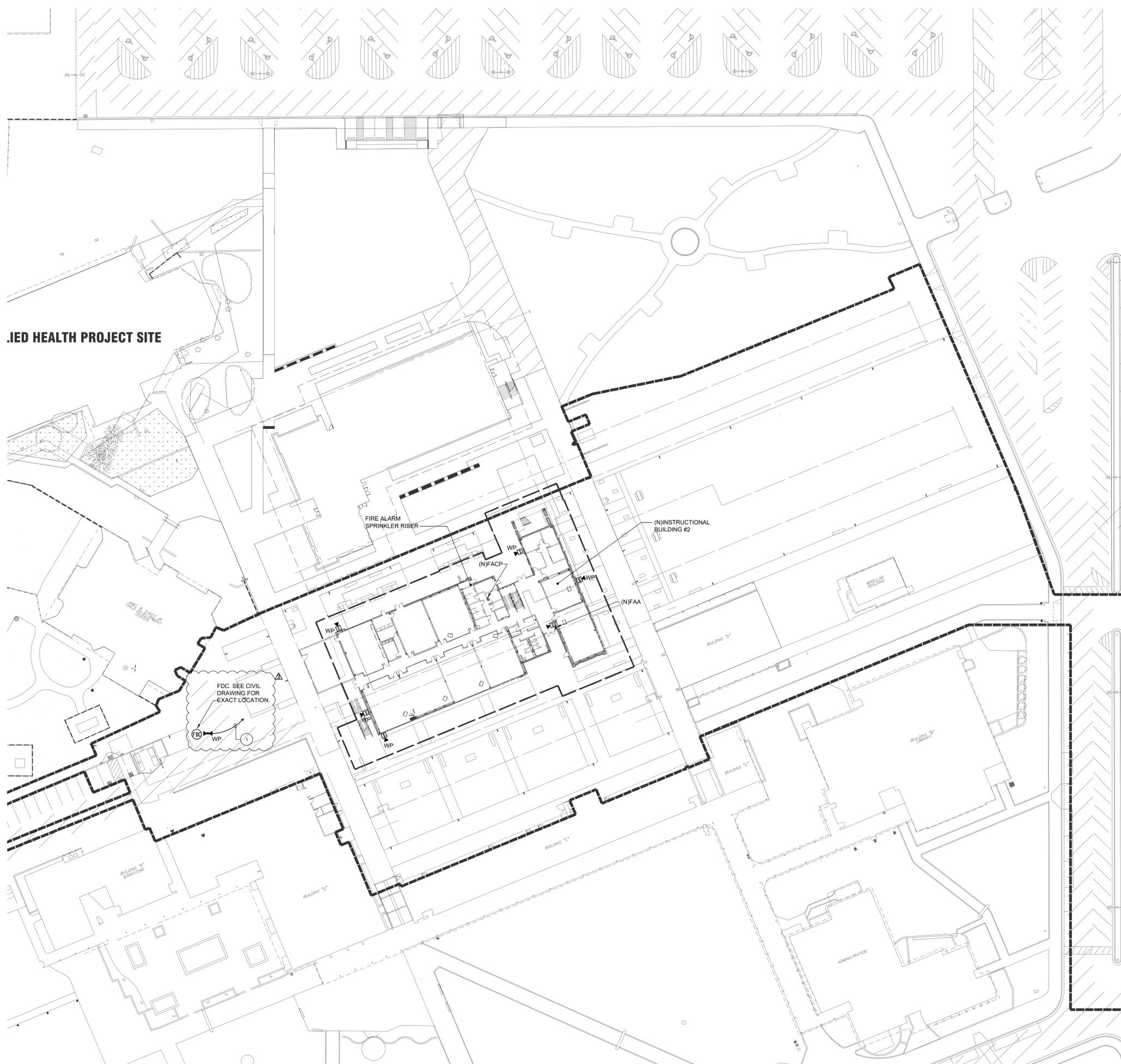
Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals
Other	9600 VA	100.00%	9600 VA	
Power	10400 VA	100.00%	10400 VA	Total Conn. Load: 22120 VA
Receptacle	2120 VA	100.00%	2120 VA	Total Est. Demand: 22120 VA
				Total Conn.: 61 A
				Total Est. Demand: 61 A

Notes:

Branch Panel: PP2A												Branch Panel: PP2B																			
Location: Space 124 Supply From: DPP2 Mounting: Surface												Location: Space 124 Supply From: DPP2 Mounting: Surface																			
Volts: 120/208 Wye Phases: 3 Wires: 4 Isolated Ground Bus:												Volts: 120/208 Wye Phases: 3 Wires: 4 Isolated Ground Bus:																			
A.I.C. Rating: Mains Type: CB Mains Rating: 400 A MCB Rating:												A.I.C. Rating: Mains Type: CB Mains Rating: 225 A MCB Rating: 100 A																			
CKT	Circuit Description	Quan	Trip	Pole	A	B	C	Pole	Trip	Quan	Circuit Description	CKT	CKT	Circuit Description	Quan	Trip	Pole	A	B	C	Pole	Trip	Quan	Circuit Description	CKT						
1	Receptacles JAN 209/TOILET 211,212	3	20 A	1	540 VA	720 VA				1	20 A	4	Receptacles LACT 201/WOMENS 203/MENS...	2	1	CR6 RECEPTACLES	5	20 A	1	900 VA	900 VA			1	20 A	5	CR4 RECEPTACLES	2			
3	Drinking Fountain CORR 200	1	20 A	1		800 VA	720 VA			1	20 A	4	Receptacles LACT 201/TOILET 205	4	3	CR6 RECEPTACLES	5	20 A	1		900 VA	900 VA			1	20 A	5	CR4 RECEPTACLES	4		
5	Hand Dryer TOILET 211	1	20 A	1			1500...	1500...			1	20 A	1	Hand Dryer WOMENS 203	6	5	CR6 LECTERN	1	20 A	1		500 VA	500 VA			1	20 A	1	CR4 LECTERN	6	
7	Hand Dryer TOILET 211	1	20 A	1	1500...	1500...					1	20 A	1	Hand Dryer WOMENS 203	8	7	CR6 PROJ. SCREEN	1	20 A	1	800 VA	800 VA			1	20 A	1	CR4 PROJ. SCREEN	8		
9	Hand Dryer TOILET 212	1	20 A	1		1500...	1500...				1	20 A	1	Hand Dryer MENS 204	10	9	CR7 RECEPTACLES	5	20 A	1		900 VA	900 VA			1	20 A	5	CR5 RECEPTACLES	10	
11	Hand Dryer TOILET 212	1	20 A	1		1500...	1500...				1	20 A	1	Hand Dryer MENS 204	12	11	CR7 RECEPTACLES	5	20 A	1		900 VA	900 VA			1	20 A	5	CR5 RECEPTACLES	12	
13	Area of Refuge Receptacle CORR.-1 200-1	1	20 A	1	500 VA	1080...					1	20 A	6	Receptacles HALL 214/CORR 200	14	13	CR7 LECTERN	1	20 A	1	500 VA	500 VA			1	20 A	1	CR5 LECTERN	14		
15	Fire Smoke Dampers 2nd FLOOR	1	20 A	1		50 VA	1500...				1	20 A	1	Phase Changing Station HALL 214-1/1	16	15	CR7 PROJ. SCREEN	1	20 A	1		800 VA	800 VA			1	20 A	1	CR5 PROJ. SCREEN	16	
17	Hand Dryer TOILET 205	1	20 A	1			1500...	180 VA			1	20 A	1	Toilet Accessories MENS 204	18	17	CR8 RECEPTACLES	5	20 A	1		900 VA	500 VA			1	20 A	1	Motor Operated Shade C.R.6 223	18	
19	Toilet Accessories WOMENS 203	1	20 A	1	180 VA	180 VA					1	20 A	1	Toilet Accessories MENS 204	20	19	CR8 RECEPTACLES	5	20 A	1	900 VA	500 VA			1	20 A	1	Motor Operated Shade C.R.7 224	20		
21	Toilet Accessories WOMENS 203	1	20 A	1		180 VA	800 VA				1	20 A	1	Refrigerator LACT. 201	22	21	CR8 LECTERN	1	20 A	1		500 VA	500 VA			1	20 A	1	Motor Operated Shade C.R.8 225	22	
23	Toilet Accessories JAN. 362	1	20 A	1		180 VA	180 VA				1	20 A	1	Toilet Accessories TOILET 211	24	23	CR8 PROJ. SCREEN	1	20 A	1		800 VA	1000...			1	20 A	2	Motor Operated Shade C.R.4 222	24	
25	Toilet Accessories JAN. 362	1	20 A	1	180 VA	180 VA					1	20 A	1	Toilet Accessories TOILET 211	26	25	Access Control Door CORR.-1 200-1	6	20 A	1	1080...	500 VA			1	20 A	1	Motor Operated Shade C.R.5 221	26		
27	Spare	--	--	--	0 VA	0 VA					1	20 A	1	Access Control Door CORR.-1 200-1	28	27	Access Control Door CORR.-1 200-1	6	20 A	1	1080...	1080...			0 VA	1080...	1	20 A	6	Access Control Door CORR.-1 200-1	28
29	Spare	--	--	--	0 VA	0 VA					1	20 A	1	Spare	30	29	Spare	--	20 A	1	0 VA	0 VA			--	20 A	1	Spare	30		
31	Spare	--	--	--	0 VA	0 VA					1	20 A	1	Spare	32	31	Spare	--	20 A	1	0 VA	0 VA			--	20 A	1	Spare	32		
33	Spare	--	--	--	0 VA	0 VA					1	20 A	1	Spare	34	33	Spare	--	20 A	1	0 VA	0 VA			--	20 A	1	Spare	34		
35	Spare	--	--	--	0 VA	0 VA					1	20 A	1	Spare	36	35	Spare	--	20 A	1	0 VA	0 VA			--	20 A	1	Spare	36		
37	Spare	--	--	--	0 VA	0 VA					1	20 A	1	Spare	38	37	Spare	--	20 A	1	0 VA	0 VA			--	20 A	1	Spare	38		
39	Spare	--	--	--	0 VA	0 VA					1	20 A	1	Spare	40	39	Spare	--	20 A	1	0 VA	0 VA			--	20 A	1	Spare	40		
41	Spare	--	--	--	0 VA	0 VA					1	20 A	1	Spare	42	41	Spare	--	20 A	1	0 VA	0 VA			--	20 A	1	Spare	42		
Total Load: 6560 VA Total Amps: 55 A												Total Load: 7380 VA Total Amps: 62 A																			

Legend:

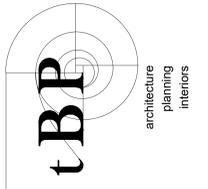
Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals
Other	12800 VA	100.00%	12800	



KEY NOTES

- 1 PROVIDE 2#16 THWN IN 3/4" C. TO FIRE RISER ROOM.

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
 4811 Teller Avenue
 Newport Beach, CA 92660
 ph: 949.673.0300 fx: 949.732.3895
 architect



FBA Engineering
 Consulting Engineers
 10000 Wilshire Blvd., Suite 1000
 Culver City, CA 90230
 Ph: 310.205.1051 (Ext)
 Fax: 310.205.1052
 FBA Job Number: 713227
 consultant

COMPTON COLLEGE
INSTRUCTIONAL BUILDING No. 2
 COMPTON COMMUNITY COLLEGE DISTRICT
 1111 E. ARTESIA BLVD. COMPTON, CA.

owner

tBP project number : 20998.00

file name:

drawn by: checked by:

date: 04/08/2019

Rev.	date:	description:
1	08/02/19	Addendum 1
2	09/04/19	Addendum 2
3	09/12/19	Addendum 3

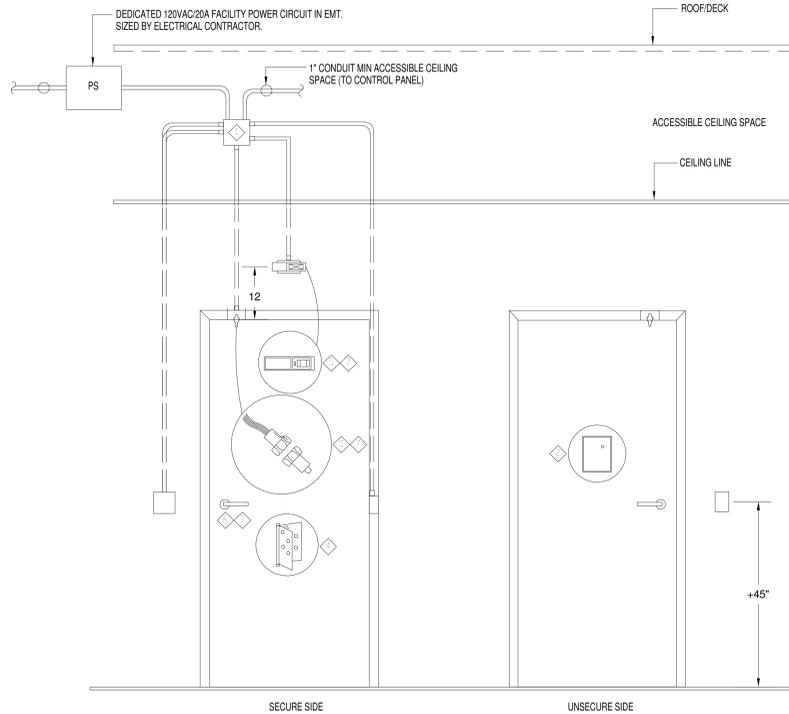
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drawing title:
**ENLARGED SITE
 FIRE ALARM PLAN**

drawing no.:
EF-1.0
 drawing of

TELECOM SYMBOL LIST

DEVICE SCHEDULE		
◇	DOOR HEADER JUNCTION BOX	DOOR HEADER JUNCTION BOX FOR HYBRID/COMPOSITE CABLE BREAKOUT AND OTHER CONNECTIONS AS REQUIRED. SIZE VERIFIED AND ENCLOSURE PROVIDED BY SECURITY CONTRACTOR.
◇	CARD READER	CARD READER - SURFACE MOUNTED TO 4S JUNCTION BOX WITH 1 GANG VERTICAL MUD RING @42" AFF ON UNSECURED SIDE. REFER TO RISER DIAGRAM FOR CABLE TYPE.
◇	DOOR CONTACTS	EXTERNAL DOOR CONTACT EMBEDDED IN DOOR FRAME 6" FROM DOOR EDGE. REFER TO RISER DIAGRAM FOR CABLE TYPE.
◇	HINGE	POWER TRANSFER HINGE - LOCK POWER, REK, DOOR POS. STATUS.
◇	REX	REX-EXTERNAL PIR SENSOR ON HORIZ. 1G CENTERED 12" ABOVE DOOR ON SECURE SIDE. REFER TO RISER DIAGRAM FOR CABLE TYPE.
◇	ELECTRIFIED DOOR HARDWARE	ELECTRIFIED DOOR HARDWARE - MORTISE OR CYLINDRICAL LEVER/LOCK SET - EGRESS FROM SECURE SIDE. REFER TO RISER DIAGRAM FOR CABLE TYPE.
◇	SUPERVISION	NO NC END-OF-LINE
◇	LOCKING HARDWARE POWER SUPPLY	LOCKING HARDWARE POWER SUPPLY-REQUIRES 120VAC, 20A DEDICATED CIRCUIT IN EMT. CODE REQUIRES LOCATION WITHIN 30 FEET OF DOOR. MULTIPLE DOORS CAN BE SERVED WHERE DISTANCE PERMITS
◇	LOCAL DOOR ALARM	



1. DETAIL IS DIAGRAMMATIC ONLY. REFER TO ARCHITECTURAL DOOR HARDWARE LIST FOR DETAILS.
2. COORDINATE WITH OTHERS TRADES TO DELIVER A COMPLETE, FUNCTIONAL SYSTEM
3. ALL CONDUIT SHALL BE 3/4" EMT COMPLETE WITH BUSHING AND PULLSTRINGS.
4. CONTRACTOR SHALL COORDINATE WITH DIVISION 8 DOOR HARDWARE CONTRACTOR AND REFERENCE ARCHITECTURAL DRAWINGS FOR DOOR HARDWARE SCHEDULE DETAIL.

TYPICAL SINGLE DOOR ACCESS CONTROL DETAIL

SCALE N.T.S. 1

- TV — TELEVISION/COAX SYSTEM - 1" C. WITH COAX CABLES AS SPECIFIED.
- M1 — MICROPHONE SYSTEM - 3/4" C. WITH CABLES AS SPECIFIED.
M2 - 1" C. WITH CABLES AS SPECIFIED.
M3 - 1 1/4" C. WITH CABLES AS SPECIFIED.
M4 - (2) 1" C. WITH CABLES AS SPECIFIED.
- ID — INTRUSION DETECTION SYSTEM - 3/4" C., WITH INTRUSION DETECTION SYSTEM CABLES AS SPECIFIED.
- 1V — TELEPHONE/VOICE SYSTEM - 3/4" C. WITH ONE (1) TELEPHONE SYSTEM CABLE AS SPECIFIED.
2V - 1" C. WITH TWO (2) TELEPHONE SYSTEM CABLES AS SPECIFIED.
3V - 1 1/4" C. WITH THREE (3) TELEPHONE SYSTEM CABLES AS SPECIFIED.
4V - 1 1/4" C. WITH FOUR (4) TELEPHONE SYSTEM CABLES AS SPECIFIED.
- P — PUBLIC ADDRESS SYSTEM - 3/4" C., WITH PA SYSTEM CABLES AS SPECIFIED.
- AV — AV SYSTEM - PROVIDE 1-1/2" C FROM AV CONTROLLER TO SWITCH AT PROJECTOR ON DISPLAY.
- 1D — COMPUTER/DATA PROCESSING SYSTEM - 1" C., WITH ONE (1) DATA NETWORK CABLE AS SPECIFIED.
2D - 1" C. WITH TWO (2) DATA NETWORK CABLES AS SPECIFIED.
3D - 1 1/4" C. WITH THREE (3) DATA NETWORK CABLES AS SPECIFIED.
4D - 1 1/4" C. WITH FOUR (4) DATA NETWORK CABLES AS SPECIFIED.
- ◇ 1D ◇ COMPUTER/DATA OUTLET ON FLUSH IN WALL OUTLET BOX, -18 IN. AFF. UNO. PROVIDE AND INSTALL ONE (1) DATA NETWORK OUTLET CONNECTOR, COVERPLATE, OUTLET BOX AND MINIMUM 1 IN. CONDUIT CONCEALED IN WALL TO ABOVE THE ACCESSIBLE CEILING SPACE. PROVIDE AND INSTALL INSULATED THROAT BUSHINGS. PROVIDE AND INSTALL ONE (1) DATA NETWORK CABLE AS SPECIFIED FROM OUTLET, THROUGH CONDUIT TO ABOVE THE CEILING AND ON TO THE RESPECTIVE BDF/IDF.
- ◇ 2D ◇ COMPUTER/DATA OUTLET ON FLUSH IN WALL OUTLET BOX, -18 IN. AFF. UNO. PROVIDE AND INSTALL TWO (2) DATA NETWORK OUTLET CONNECTORS, COVERPLATE, OUTLET BOX AND MINIMUM 1 IN. CONDUIT CONCEALED IN WALL TO ABOVE THE ACCESSIBLE CEILING SPACE. PROVIDE AND INSTALL INSULATED THROAT BUSHINGS. PROVIDE AND INSTALL TWO (2) DATA NETWORK CABLES AS SPECIFIED FROM OUTLET, THROUGH CONDUIT TO ABOVE THE CEILING AND ON TO THE RESPECTIVE BDF/IDF.
- ◇ 3D ◇ COMPUTER/DATA OUTLET ON FLUSH IN WALL OUTLET BOX, -18 IN. AFF. UNO. PROVIDE AND INSTALL THREE (3) DATA NETWORK OUTLET CONNECTORS, COVERPLATE, OUTLET BOX AND MINIMUM 1.25 IN. CONDUIT CONCEALED IN WALL TO ABOVE THE ACCESSIBLE CEILING SPACE. PROVIDE AND INSTALL INSULATED THROAT BUSHINGS. PROVIDE AND INSTALL THREE (3) DATA NETWORK CABLES AS SPECIFIED FROM OUTLET, THROUGH CONDUIT TO ABOVE THE CEILING AND ON TO THE RESPECTIVE BDF/IDF.
- ◇ 4D ◇ COMPUTER/DATA OUTLET ON FLUSH IN WALL OUTLET BOX, -18 IN. AFF. UNO. PROVIDE AND INSTALL FOUR (4) DATA NETWORK OUTLET CONNECTORS, COVERPLATE, OUTLET BOX AND MINIMUM 1.25 IN. CONDUIT CONCEALED IN WALL TO ABOVE THE ACCESSIBLE CEILING SPACE. PROVIDE AND INSTALL INSULATED THROAT BUSHINGS. PROVIDE AND INSTALL FOUR (4) DATA NETWORK CABLES AS SPECIFIED FROM OUTLET, THROUGH CONDUIT TO ABOVE THE CEILING AND ON TO THE RESPECTIVE BDF/IDF.
- ◇ 6D ◇ COMPUTER/DATA OUTLET ON FLUSH IN WALL OUTLET BOX, -18 IN. AFF. UNO. PROVIDE AND INSTALL SIX (6) DATA NETWORK OUTLET CONNECTORS, COVERPLATE, OUTLET BOX AND MINIMUM 1.25 IN. CONDUIT CONCEALED IN WALL TO ABOVE THE ACCESSIBLE CEILING SPACE. PROVIDE AND INSTALL INSULATED THROAT BUSHINGS. PROVIDE AND INSTALL SIX (6) DATA NETWORK CABLES AS SPECIFIED FROM OUTLET, THROUGH CONDUIT TO ABOVE THE CEILING AND ON TO THE RESPECTIVE BDF/IDF.
- ◇ 1T ◇ TELEPHONE OUTLET IN FLUSH IN WALL OUTLET BOX, +45 IN. AFF. UNO. PROVIDE AND INSTALL HANDSET, VOICE OUTLET CONNECTOR, OUTLET BOX AND 1 IN. CONDUIT CONCEALED IN WALL TO ABOVE THE ACCESSIBLE CEILING. PROVIDE AND INSTALL ONE (1) DATA NETWORK CABLE AS SPECIFIED FROM THE OUTLET, IN CONDUIT AND TERMINATE AT THE RESPECTIVE BDF/IDF.
- ◇ 1D ◇ WIRELESS ACCESS POINT AT CEILING. PROVIDE AND INSTALL ACCESS POINT, ONE (1) DATA NETWORK CABLE WITH 15 FOOT SERVICE LOOPS, BACK TO THE RESPECTIVE BDF/IDF. INSTALL ACCESS POINT IN ACCORDANCE WITH THE EQUIPMENT MANUFACTURERS INSTALLATION REQUIREMENTS.
- ◇ 1D ◇ WIRELESS ACCESS POINT, WALL MOUNTED AT +90 IN. UNO. PROVIDE AND INSTALL ACCESS POINT, ONE (1) DATA NETWORK CABLE WITH 20 FOOT SERVICE LOOP BACK TO THE RESPECTIVE BDF/IDF. INSTALL ACCESS POINT IN ACCORDANCE WITH THE EQUIPMENT MANUFACTURERS INSTALLATION REQUIREMENTS. OUTDOOR LOCATIONS SHALL BE WEATHERPROOF.
- ◇ 1D ◇ COMPUTER/DATA OUTLET CONNECTOR AT CEILING AND CONNECTION TO IN CEILING AV AMPLIFIER AND PROJECTION SYSTEM. INSTALL IN ACCORDANCE WITH THE AV SYSTEM MANUFACTURERS REQUIREMENTS.

- "E" DESIGNATION INDICATES DEDICATED TELEPHONE LINES FOR ELEVATOR.
- IM INTERCOM MICROPHONE ON FLUSH CEILING MOUNTED OUTLET BOX.
- S AUDIO ENHANCEMENT SPEAKER IN FLUSH CEILING MOUNTED BACKBOX.
- 12" DIA. ANALOG SELF CORRECTING 120V, OPERATED CLOCK, -30" A.F.F. REFER TO ARCHITECTURAL INTERIOR ELEVATIONS FOR EXACT LOCATIONS AND MOUNTING HEIGHTS.
- +45" MOUNTING HEIGHT TO CENTER LINE OF DEVICE FROM FINISH FLOOR OR EXTERIOR GRADE
- 1 PLAN NOTE CALLOUT. REFER TO CORRESPONDING NOTE ON DRAWING WHERE CALLOUT OCCURS.
- WP P WEATHERPROOF EXTERIOR LONG THROW PUBLIC ADDRESS HORN SPEAKER, WALL MOUNTED.
- AV AV CONNECTOR PLATE ON FLUSH IN WALL OUTLET BOX, +90 IN. AFF. UNO. INSTALL IN FLUSH IN WALL BOX. SIZE PER MANUFACTURERS REQUIREMENTS. AT LCD DISPLAY LOCATION. PROVIDE 1.25 IN. CONDUIT TO ABOVE THE ACCESSIBLE CEILING. PROVIDE AV CABLES AS SPECIFIED.
- AV AV IN CEILING AMPLIFIER NEAR PROJECTOR LOCATION AS SPECIFIED FOR TERMINATION/CONNECTION OF AV AND PROJECTION SYSTEM. PROVIDE AND INSTALL COMPLETE AS SPECIFIED AND IN ACCORDANCE WITH THE EQUIPMENT MANUFACTURERS REQUIREMENTS.
- TC AUDIO/VIDEO CONTROL PANEL, ON FLUSH IN WALL MOUNTED OUTLET BOX, +45" A.F.F. LOCATED AT INSTRUCTOR'S DESK. PROVIDE CONTROL PANEL, OUTLET BOX AND 1" CONDUIT CONCEALED IN WALL TO THE AV CONNECTOR PLATE. AT +18" A.F.F. PROVIDE AV CABLES BETWEEN AV CONTROL PANEL AND AV CONNECTOR PLATE IN ACCORDANCE WITH THE AV SYSTEM REQUIREMENTS.
- TV TELEVISION/COAX OUTLET ON FLUSH IN WALL OUTLET, +60" U.O.N.
- G GLASS BREAK DETECTOR.
- K INTRUSION DETECTION KEY PAD, ON FLUSH WALL MOUNTED OUTLET BOX, +45".
- C INTRUSION DETECTION SYSTEM DOOR CONTACT SWITCH. INSTALL IN ACCORDANCE WITH THE MANUFACTURERS REQUIREMENTS.
- V MINI INTRUSION SIREN
- D INTRUSION DETECTION OCCUPANCY MOTION SENSOR, ON FLUSH CEILING MOUNTED OUTLET BOX.
- P INTRUSION PANIC BUTTON IN FLUSH IN WALL OUTLET BOX, +45".
- M MICROPHONE OUTLET, ON FLUSH WALL MOUNTED OUTLET BOX, +18".
- E ASSISTIVE LISTENING SYSTEM EMITTER, +90".
- VF HANDS-FREE IP CALL BOX, FLUSH WALL MOUNT, +45".
- S ID INDOOR PUBLIC ADDRESS SPEAKER. PROVIDE AND INSTALL ON FLUSH IN CEILING BACKBOX. PROVIDE AND INSTALL ONE (1) DATA NETWORK CABLE ABOVE THE CEILING FROM THE SPEAKER TO THE RESPECTIVE BDF/IDF. PROVIDE INDOOR CEILING MOUNTED PAGING SPEAKERS POE+ IP BASED. AIBHED #HWP+ COMPLETE WITH FLUSH MOUNT ENCLOSURE SPEAKERS, BACKBOX AND VANDAL RESISTANT GRILLE. INSTALL IN CEILING SYSTEMS PER MANUFACTURERS REQUIREMENTS.
- CR ACCESS CONTROL CARD READER. PROVIDE AND INSTALL IN FLUSH IN WALL OUTLET BOX, +45 IN. AFF. PROVIDE AND INSTALL A .75 IN. CONDUIT CONCEALED IN WALL TO THE CONTROLLER/POWER SUPPLY ABOVE THE ACCESSIBLE CEILING. SEE SPECIFICATIONS.
- J F COMPUTER/DATA NETWORK FURNITURE FEED WALL MOUNTED JUNCTION BOX, -18 IN. AFF. UNO. PROVIDE AND INSTALL JUNCTION BOX, SEAL, TITE FLEX CONDUIT, 1.25 IN. MINIMUM AND CONNECTION TO THE FURNITURE SYSTEM. PROVIDE AND INSTALL OUTLET BOX(S) SIZED TO ACCOMMODATE THE QUANTITY OF CABLES INDICATED. PROVIDE QUANTITY OF 1.25 IN. CONDUITS FROM JUNCTION BOX, CONCEALED IN WALL TO ABOVE THE ACCESSIBLE CEILING. PROVIDE AND INSTALL ONE (1) 1.25 IN. CONDUIT FOR EVERY SIX (6) DATA NETWORK CABLES REQUIRED. TERMINATE CABLES AT THE RESPECTIVE BDF/IDF.
- C INDOOR CLOSED-CIRCUIT TELEVISION CAMERA, CEILING MOUNTED. PROVIDE AND INSTALL CCTV CAMERA AS SPECIFIED, CEILING OUTLET BOX AND ONE (1) DATA NETWORK CABLE FROM CAMERA TO THE RESPECTIVE BDF/IDF. PROVIDE 20 FOOT CABLE SERVICE LOOP AT CAMERA LOCATION.
- C OUTDOOR CLOSED-CIRCUIT TELEVISION CAMERA, WALL MOUNT AT +108 IN. A.F.G. PROVIDE AND INSTALL CCTV CAMERA AS SPECIFIED, WEATHERPROOF WALL MOUNTED OUTLET BOX AND ONE (1) DATA NETWORK CABLE FROM CAMERA TO THE RESPECTIVE BDF/IDF. PROVIDE 20 FOOT CABLE SERVICE LOOP AT CAMERA LOCATION.
- △ MULTI-SERVICE POWER/DATA FLUSH IN FLOOR BOX COMPLETE WITH FLUSH COVER. PROVIDE AND INSTALL MULTI SERVICE FLOOR BOX WITH QUANTITY OF DUPLEX POWER OUTLETS (SEE POWER PLANS) AND COMPUTER/DATA OUTLET CONNECTORS INDICATED. PROVIDE ONE (1) 1.25 IN. BELOW GRADE CONDUIT FOR EVERY FOUR (4) DATA OUTLET CONNECTORS AND CABLES INDICATED. PROVIDE AND INSTALL QUANTITY OF CABLES INDICATED AND TERMINATE AT THE RESPECTIVE BDF/IDF. PROVIDE ONE (1) DATA NETWORK TERMINATION DEVICE IN THE FURNITURE SYSTEM FOR EACH WORK STATION INDICATED AND CONNECT IN ACCORDANCE WITH THE FURNITURE SYSTEMS MANUFACTURERS REQUIREMENTS.
- △ MULTI-SERVICE POWER/DATA/AUDIO VISUAL FLUSH IN FLOOR BOX COMPLETE WITH FLUSH COVER. PROVIDE AND INSTALL MULTI SERVICE FLOOR BOX WITH QUANTITY OF DUPLEX POWER OUTLETS (SEE POWER PLANS), COMPUTER/DATA OUTLET CONNECTORS AND AUDIO VIDEO CONNECTOR PLATES AS INDICATED. PROVIDE ONE (1) 1.25 IN. BELOW GRADE CONDUIT FOR EVERY FOUR (4) DATA OUTLET CONNECTORS AND CABLES INDICATED. PROVIDE AND INSTALL QUANTITY OF CABLES INDICATED AND TERMINATE AT THE RESPECTIVE BDF/IDF. FOR AV, PROVIDE AND INSTALL INSTRUCTOR'S AV CONNECTOR PLATE, ONE (1) 1.5 IN. CONDUIT FROM THE FLOOR BOX, TO THE WALL AND TO ABOVE THE ACCESSIBLE CEILING. PROVIDE HDMI/VGA CABLES, ETC. AS SPECIFIED.
- △ PT SIMILAR TO MULTI-SERVICE POWER/DATA FLUSH IN FLOOR BOX BUT POKE THROUGH DEVICE AT UPPER FLOORS. "PT" DESIGNATION INDICATES PROVIDE AND INSTALL POKE THROUGH DEVICE AS SPECIFIED.
- △ PT SIMILAR TO MULTI-SERVICE POWER/DATA/AV FLUSH IN FLOOR BOX BUT POKE THROUGH DEVICE AT UPPER FLOORS. "PT" DESIGNATION INDICATES PROVIDE AND INSTALL POKE THROUGH DEVICE AS SPECIFIED.

DIVISION OF THE STATE ARCHITECT
355 South Grand Avenue, Suite 2100
Los Angeles, CA 90012
ph: (213) 897-3995 fx: (213) 897-3159
agency

architecture
planning
interiors

IBP/Architecture
4611 Teller Avenue
Newport Beach, CA 92660
ph: 949.673.0000 fx: 949.732.3895

architect

FBA Engineering
Consulting Electrical Engineers
4611 Teller Avenue
Newport Beach, CA 92660
ph: 949.673.0000 fx: 949.732.3895
FBA Job Number: 212.227

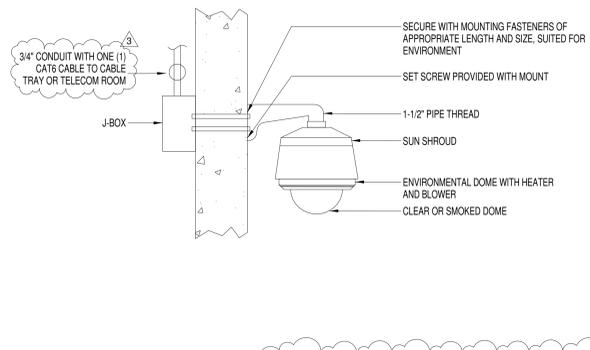
consultant

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:
1	08/02/19 Addendum 1
2	09/04/19 Addendum 2
3	09/12/19 Addendum 3

drawing title:
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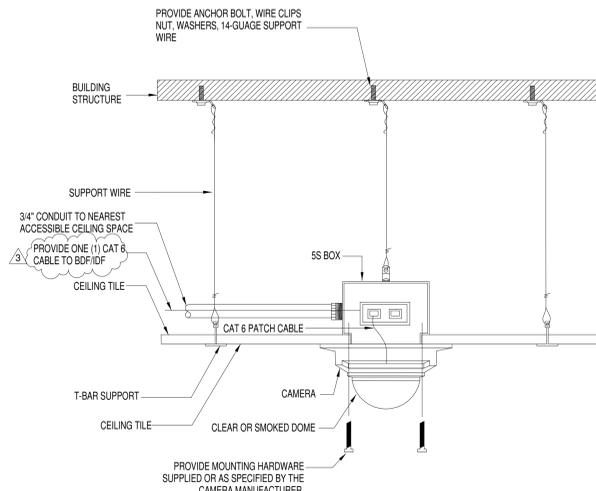
drawing
ET-0.1
drawing of



ALL EXTERIOR WALL MOUNT CAMERAS SHALL BE AXIS Q6032-E PTZ DOME NETWORK CAMERAS. CONTRACTOR FURNISHED AND INSTALLED. COMPLETE WITH ALL MOUNTING HARDWARE AND ACCESSORIES FOR A COMPLETE INSTALLATION.

EXTERIOR WALL MOUNT CAMERA

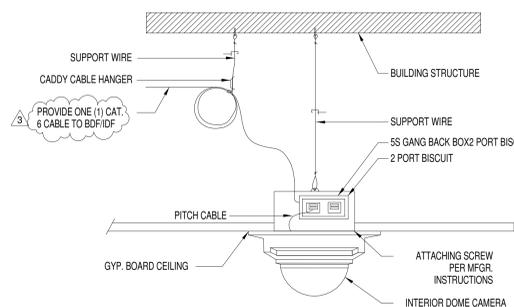
SCALE N.T.S. 2



ALL CEILING MOUNT CAMERAS SHALL BE AXIS M3007-PV VANDAL AND DUST RESISTANT. CONTRACTOR FURNISHED AND INSTALLED. COMPLETE WITH ALL MOUNTING HARDWARE AND ACCESSORIES FOR A COMPLETE INSTALLATION.

DROP TILE MOUNT CAMERA

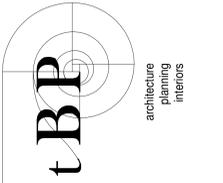
SCALE N.T.S. 3



ALL CEILING MOUNT CAMERAS SHALL BE AXIS M3007-PV VANDAL AND DUST RESISTANT. CONTRACTOR FURNISHED AND INSTALLED. COMPLETE WITH ALL MOUNTING HARDWARE AND ACCESSORIES FOR A COMPLETE INSTALLATION.

HARD LID MOUNT CAMERA

SCALE N.T.S. 4



IBP/Architecture
 4611 Teller Avenue
 Newport Beach, CA 92660
 ph: 949.673.0300 fx: 949.732.3895

architect



FBA Engineering
 Consulting Electrical Engineers
 10000 Wilshire Blvd, Suite 1100
 Culver City, CA 90230
 Tel: 310.440.1100
 Fax: 310.440.1101
 www.fba-engineering.com
 #BX Job Number: 210.227

consultant

COMPTON COLLEGE
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owner

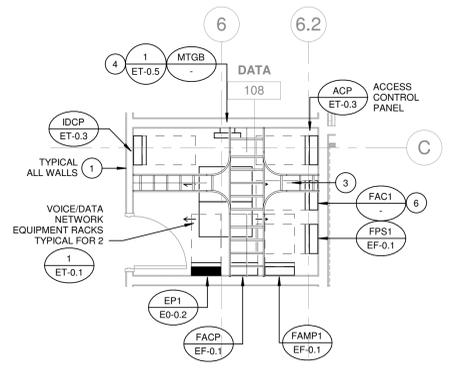
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3	09/12/19 Addendum 3

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drawing title:
ENLARGED TELECOM ROOMS

drawing
ET-0.2
 drawing of

- ENLARGED BDF/IDF KEY NOTES:**
- 1 PROVIDE 8'-0" X 3'-4" THICK FIRE TREATED PLYWOOD BACKBOARD, PAINT OFF WHITE PER DISTRICTS IT STANDARDS.
 - 2 PROVIDE 18" WIDE X 4" DEEP LADDER RACK CABLE TRAY SYSTEM. SEISMIC BRACE ALL CABLE RACEWAYS AND RACKS USING 1/2" ALL THREAD TO CEILING STRUCTURE PER MANUFACTURER'S INSTRUCTIONS AND CODE REQUIREMENTS.
 - 3 PROVIDE CABLE WATERFALL TROUGH OVER EACH RACK.
 - 4 PROVIDE MAIN TECHNICAL GROUND BUS PER DETAIL 1/ET-0.5. BOND ALL METAL COMPONENTS TO THE TECHNICAL GROUND BUS. ALL RACKS TO BOND INDIVIDUALLY WITH MINIMUM #6 AWG CONDUCTOR. WALL MOUNT GROUND BUS ON WALL AT 4'-7" O'.
 - 5 ALL COMPONENTS TO COLOR MATCH (BLACK). SEE SPECIFICATIONS.
 - 6 TERMINAL CABINET 24" W X 36" H X 6" D, SURFACE MOUNT.
 - 7 PROVIDE DATA SYSTEM GROUND BUS. BOND ALL METAL COMPONENTS TO GROUND BUS, INCLUDING RACKS AND TERMINAL CABINET WITH MINIMUM #6 GROUND WIRE.

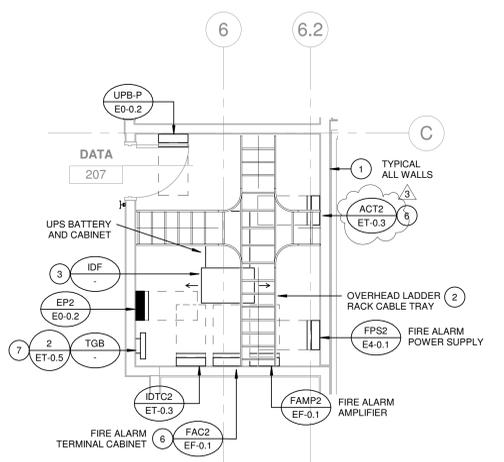


ENLARGED BDF ROOM - LEVEL 01
 SCALE 1/4" = 1'-0" 1

LOW VOLTAGE TASK RESPONSIBILITY MATRIX					
ITEM	GC	EC	CC	AVC	SC
EQUIPMENT					
AV EQUIPMENT - AV SPEAKER SYSTEMS		Y			Z
AV EQUIPMENT - ALL OTHER AV EQUIPMENT					X
SECURITY EQUIPMENT AND CONFIGURATIONS					X
INFRASTRUCTURE / COMMISSIONING					
INTRA-BUILDING LOW VOLTAGE CONTINUOUS CONDUITS		X			
INTRA-BUILDING LOW VOLTAGE CONDUIT ID LABELING & PULL STRINGS		X			
BUILDING INTERIOR LOW VOLTAGE BACK BOXES / CONDUIT		X			
TELECOM & AV FLOOR BOXES & POKE THRU'S		X			
BDF/IDF ROOM CABLE TERMINATION HARDWARE			X		
BDF/IDF ROOM CABLE MANAGEMENT HARDWARE			X		
HORIZONTAL STATION CABLE			X		
BDF/IDF ROOM CABLE RUNWAY			X		
BDF/IDF ROOM & AV ROOM POWER		X			
INTRA-BUILDING GROUND SYSTEM TO TELECOM AND AV ROOMS		X			
TELECOM ROOM EQUIPMENT GROUNDING			X		
AV CABLING AND TERMINATION			X		X
AV SYSTEM TEST, COMMISSIONING AND TRAINING					X
SECURITY CONDUIT ID LABELING, PULL STRINGS		X			
SECURITY ROOM ACCESS POWER		X			
SECURITY SYSTEM CONDUIT AND PULLBOXES		X			
SECURITY CAMERA CABLING			X		
SECURITY ACCESS CONTROL CABLING					X
SECURITY ACCESS CONTROL CABLING SUPPORTS					X
SECURITY SYSTEM PROGRAMMING					X
SECURITY SYSTEM TEST, COMMISSIONING AND TRAINING					X
STRUCTURAL / SUPPORTS					
BDF/IDF ROOM BACKBOARDS		X			
LOW VOLTAGE/SECURITY ROOM BACKBOARDS		X			
BDF/IDF ROOM EQUIPMENT RACKS LADDER RACKS & BRACKETS			X		
SECURITY RACKS & BRACKETS					X
BACKING, BLOCKING & OTHER STRUCTURAL SUPPORTS FOR LOW VOLTAGE, AV, SECURITY EQUIPMENT		X			
DOOR LOCKING HARDWARE AND INSTALLATION		X			

MATRIX NOTES:
 X - PROVIDED AND FULLY INSTALLED/TEST BY TRADE ENTITY
 Y - PROVIDED AND PARTIALLY INSTALLED BY TRADE ENTITY PER SPECIFICATION SECTION
 Z - FINAL ASSEMBLY, CABLE TERMINATION AND TESTING BY TRADE ENTITY PER SPECIFICATION SECTION

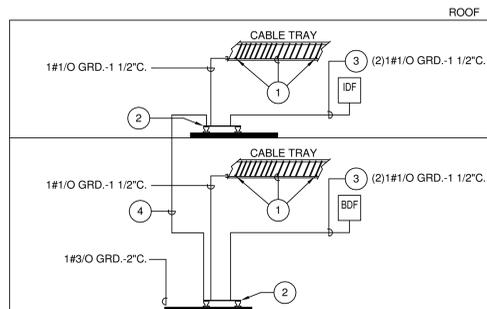
GENERAL NOTES:
 1. GC = GENERAL CONTRACTOR
 2. SC = SECURITY CONTRACTOR
 3. EC = ELECTRICAL CONTRACTOR
 4. CC = CABLE CONTRACTOR
 5. AVC = AUDIO VISUAL CONTRACTOR



ENLARGED IDF ROOM - LEVEL 02
 SCALE 1/4" = 1'-0" 2

BUILDING GROUNDING RISER DIAGRAM NOTES:

- 1 THE CABLE TRAY SHALL BE GROUNDING WITH 1#6 INSULATED GREEN COLORED GROUND CONDUCTOR RUN THE ENTIRE LENGTH OF THE CABLE TRAY. EACH CABLE TRAY SECTION SHALL BE CONNECTED TO THE GROUNDING CONDUCTOR VIA A LAY-IN TYPE LUG.
- 2 GROUND BUS. SEE DETAILS ON SHEET E3-1.
- 3 PROVIDE 1#1/0 GRD. 1 1/2" C. TO EACH BDF TRACK AND BOND AS REQUIRED.
- 4 DAISY CHAIN 1#1/0 GROUND BUS TO EACH FLOOR GROUND BUS.



BUILDING GROUNDING RISER DIAGRAM

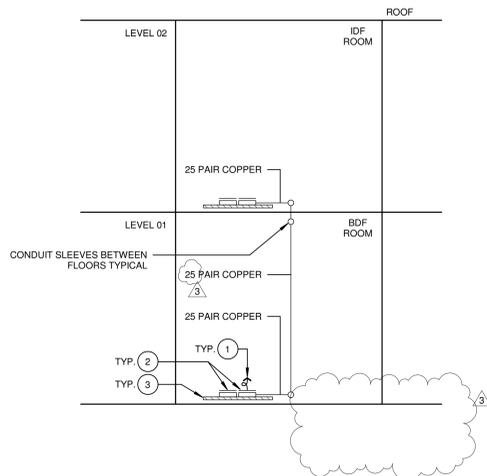
SCALE
N.T.S.

NOTE:
ALL CABLE SHALL BE RISER
RATED INSIDE OF BUILDING

REFERENCE SECTION 271000 FOR
ADDITIONAL REQUIREMENTS

PLAN NOTES:

- 1 CONNECT TELEPHONE WIRES TO COMPUTER RACK PATCH PANEL AS REQUIRED.
- 2 TELEPHONE PUNCH DOWN BLOCK (110 TERMINAL BLOCKS), QUANTITY AS REQUIRED.
- 3 FIRE RESISTANT PLYWOOD BACKBOARD, SIZE/QUANTITY AS REQUIRED.

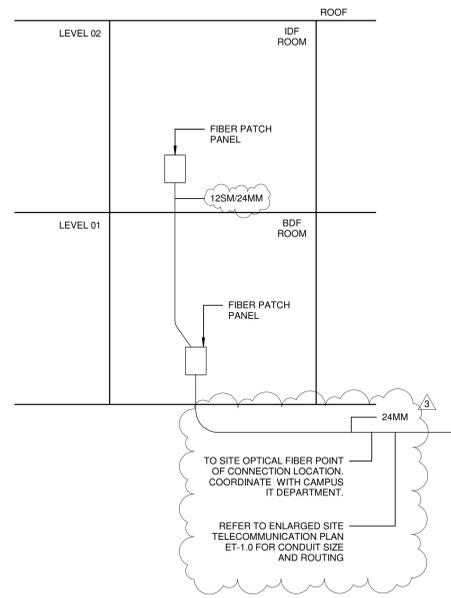


COPPER RISER DIAGRAM

SCALE
N.T.S.

NOTE:
ALL CABLE SHALL BE RISER
RATED INSIDE OF BUILDING

REFERENCE SECTION 271000 FOR
ADDITIONAL REQUIREMENTS

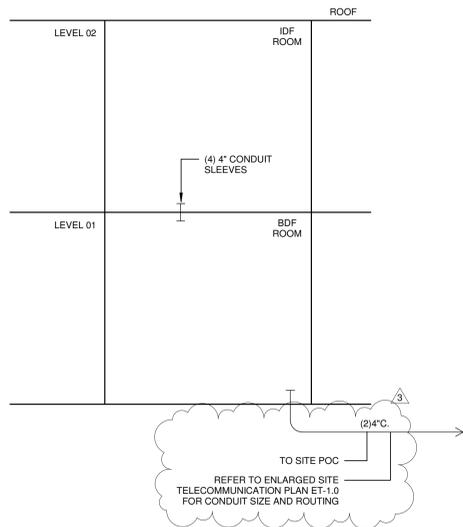


FIBER RISER DIAGRAM

SCALE
N.T.S.

NOTE:
ALL CABLE SHALL BE RISER
RATED INSIDE OF BUILDING

REFERENCE SECTION 271000 FOR
ADDITIONAL REQUIREMENTS

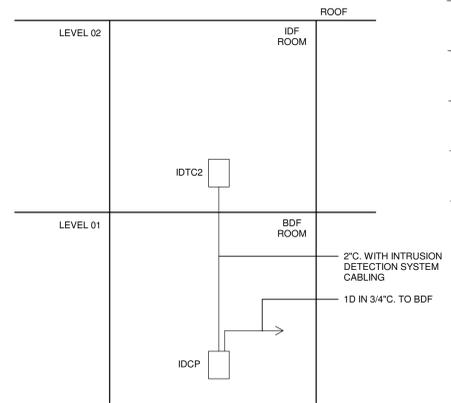


TELECOM CONDUIT RISER DIAGRAM

SCALE
N.T.S.

NOTE:
ALL CABLE SHALL BE RISER
RATED INSIDE OF BUILDING

REFERENCE SECTION 271000 FOR
ADDITIONAL REQUIREMENTS



INTRUSION DETECTION RISER DIAGRAM

SCALE
N.T.S.

ACCESS CONTROL RISER DIAGRAM

SCALE
N.T.S.

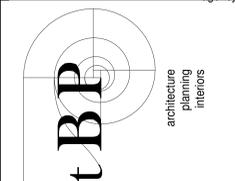
TELECOM CONDUIT RISER DIAGRAM

SCALE
N.T.S.

INTRUSION DETECTION RISER DIAGRAM

SCALE
N.T.S.

DIVISION OF THE STATE ARCHITECT
355 South Grand Avenue, Suite 2100
Los Angeles, CA 90012
ph: (213) 897-3995 fx: (213) 897-3159
agency



IBP/Architecture
4611 Teller Avenue
Newport Beach, CA 92660
ph: 949.673.0300 fx: 949.732.3895
architect



FBA Engineering
Consulting Electrical Engineers
10000 Wilshire Blvd., Suite 1100
Beverly Hills, CA 90210
ph: 310.274.1100
FBA Job Number: 212.227
consultant

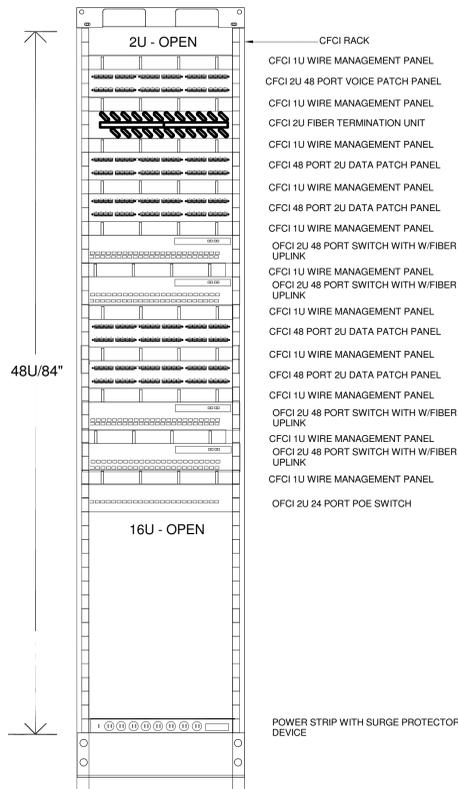
COMPTON COLLEGE
INSTRUCTIONAL BUILDING No.2
COMPTON COMMUNITY COLLEGE DISTRICT
1111 E. ARTESIA BLVD. COMPTON, CA.
owner

IBP project number: 20998.00
file name:
drawn by: checked by:
date: 04 / 08 / 2019
rev: date: description:
1 08/02/19 Addendum 1
2 09/04/19 Addendum 2
3 09/12/19 Addendum 3

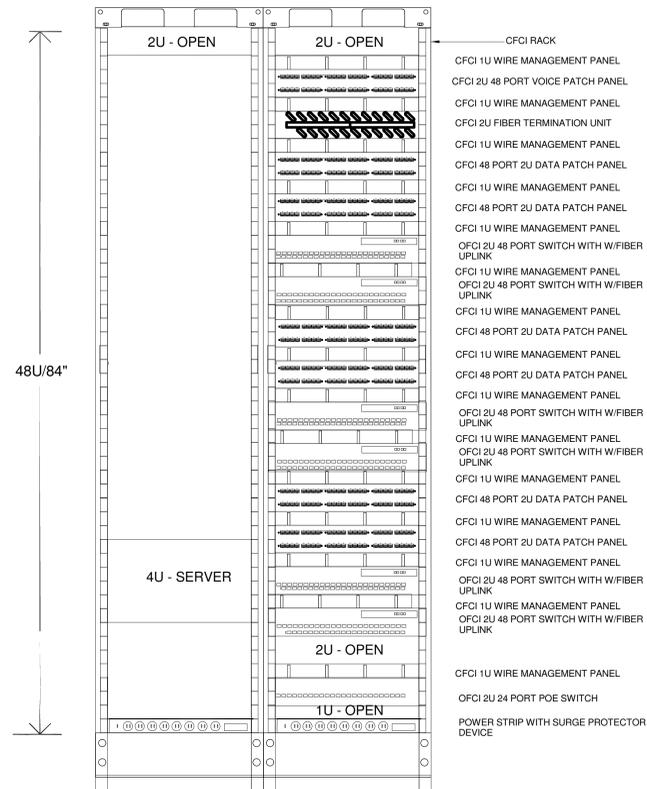
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TELECOM RISER DIAGRAMS

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drawing of



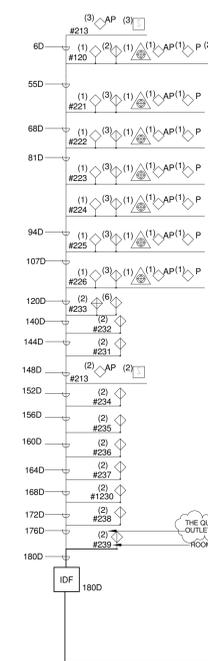
IDF RACK ELEVATION



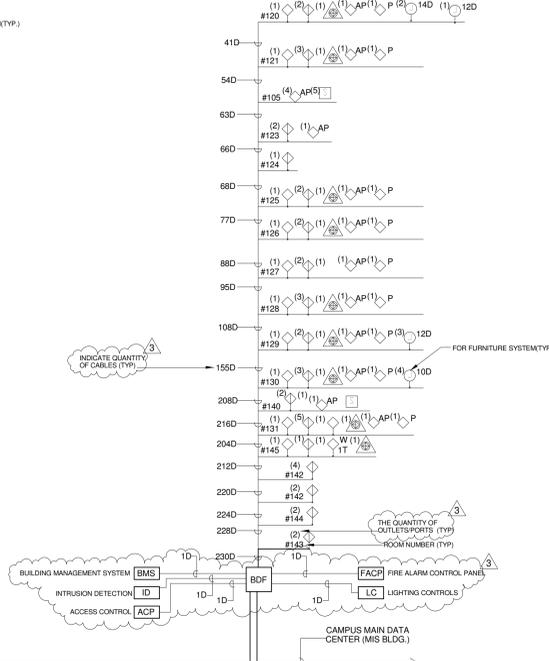
BDF RACK ELEVATION

PROVIDE QUANTITY OF SWITCHES TO MATCH TELECOM PLAN REQUIREMENTS. PROVIDE ONE(1) ADDITIONAL 48 PORT SWITCH IN EACH RACK FOR EXPANSION.

PROVIDE QUANTITY OF SWITCHES TO MATCH TELECOM PLAN REQUIREMENTS. PROVIDE ONE(1) ADDITIONAL 48 PORT SWITCH IN EACH RACK FOR EXPANSION.



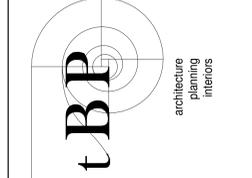
IDF-SECOND FLOOR



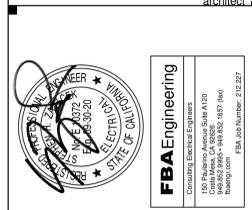
BDF-FIRST FLOOR

COMPUTER/DATA NETWORK RISER DIAGRAM

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ph: (213) 897-3995 fx: (213) 897-3159
agency



tBP Architecture
4611 Teller Avenue
Newport Beach, CA 92660
ph: 949.673.0300 fx: 949.732.3895



consultant

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1111 E. ARTESIA BLVD. COMPTON, CA.

owner

IBP project number: 20998.00

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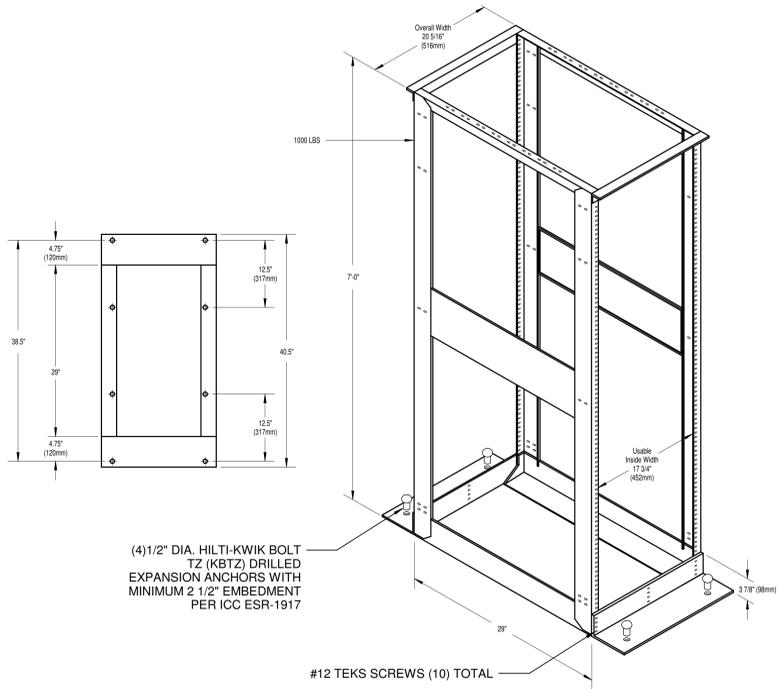
date: 04 / 08 / 2019

rev:	date:	description:
1	08/02/19	Addendum 1
2	09/04/19	Addendum 2
3	09/12/19	Addendum 3

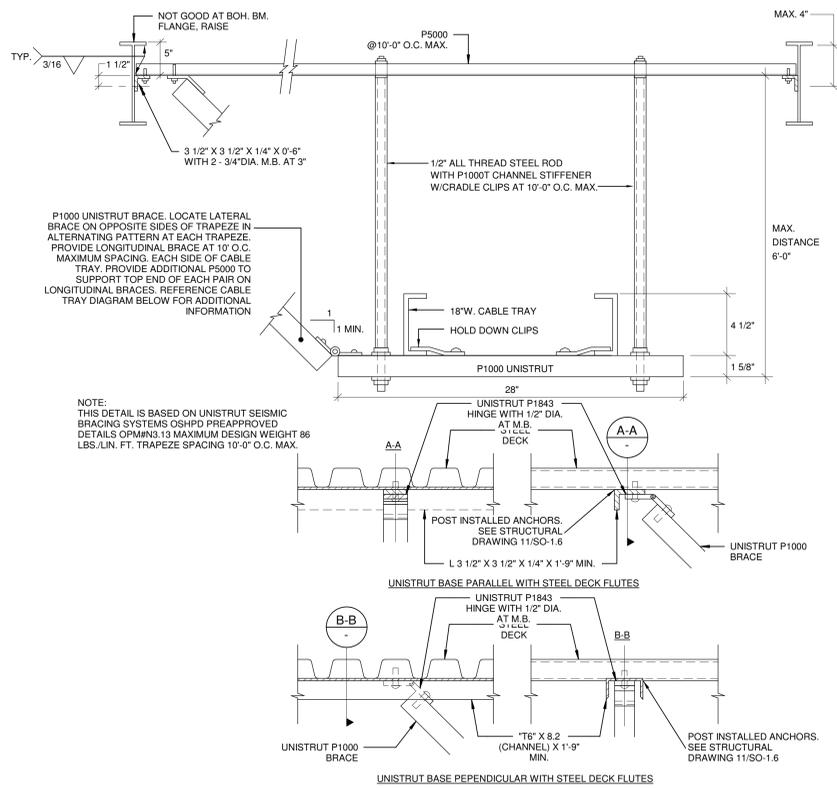
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TELECOM DETAILS

drawing of
ET-0.4



4 - POST RACK ANCHORAGE DETAIL SCALE N.T.S. 6

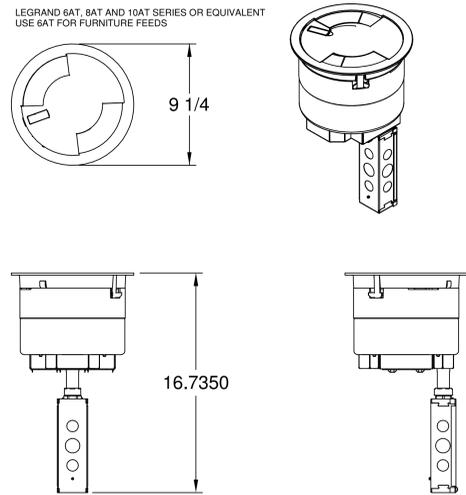


CABLE TRAY ANCHORAGE DETAIL SCALE N.T.S. 3

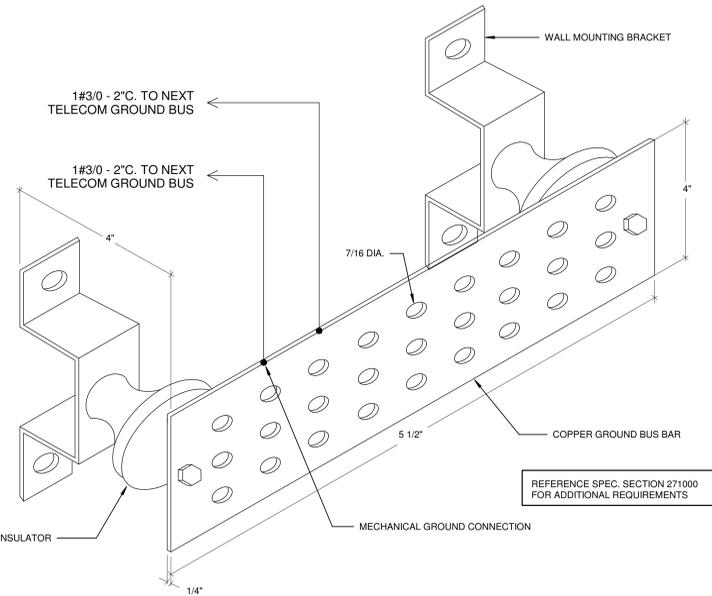
TELECOMMUNICATIONS PERFORMANCE NOTES:

- REFER TO ARCHITECTURAL DRAWINGS AND ELEVATIONS FOR CASEWORK LOCATIONS AND INSTALL ALL OUTLETS IN MOUNTING HEIGHTS AND LOCATIONS AS DIRECTED BY THE ARCHITECT. VERIFY ALL MOUNTING HEIGHTS AND LOCATIONS PRIOR TO ROUGH-IN. CONTRACTOR SHALL INCLUDE ALL COSTS IN BID TO COMPLY WITH THIS PROVISION.
- VOIP CISCO TELEPHONES SHALL BE COLLEGE PROVIDED AND INSTALLED.
- EACH CLASSROOM WILL BE EQUIPPED WITH AN INSTRUCTOR LECTERN AS MANUFACTURED BY SPECTRUM INDUSTRIES, MEDIA MANAGER SERIES OR EQUAL. CONTRACTOR SHALL COORDINATE INSTALLATION OF ALL EQUIPMENT AND CONNECTIONS WITH THE LECTERN PROVIDER. INCLUDE ALL COSTS IN BID TO COMPLY WITH THIS PROVISION.
- COORDINATE ALL ELECTRICAL AND COMPUTER/DATA/VOICE OUTLET CONNECTIONS TO FURNITURE SYSTEMS WITH COLLEGE AND FURNITURE SYSTEMS INSTALLER. PROVIDE ALL CONDUIT, CABLE AND CONNECTIONS FOR A COMPLETE INSTALLATION.

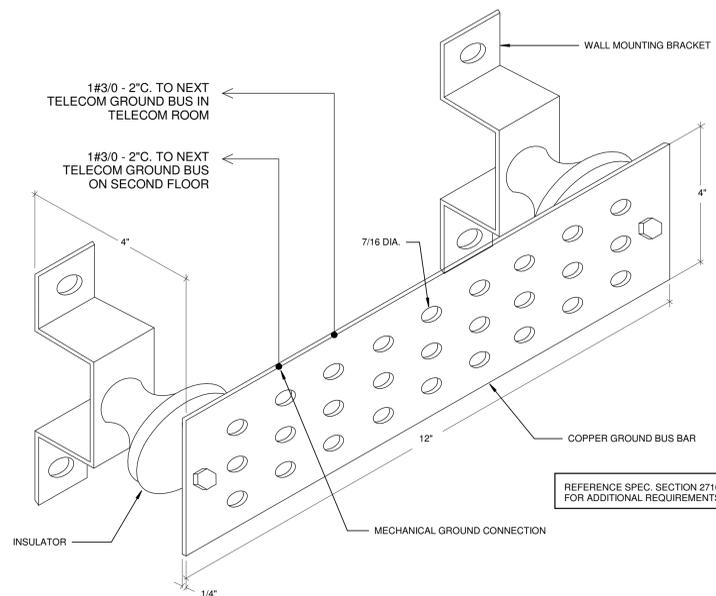
LEGRAND 6AT, 8AT AND 10AT SERIES OR EQUIVALENT
USE 6AT FOR FURNITURE FEEDS



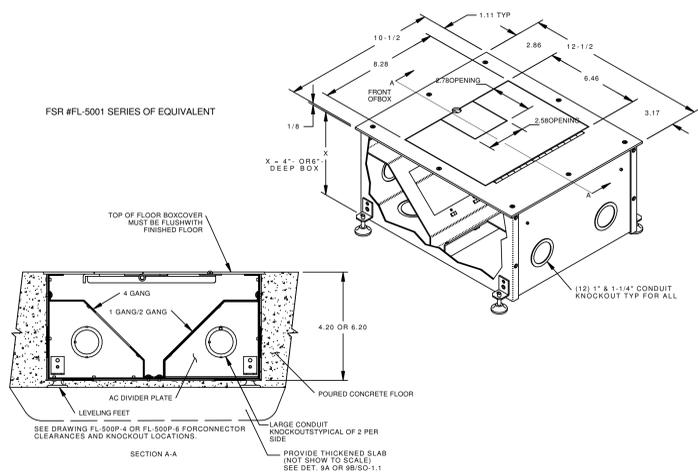
POKE-THRU DETAIL SCALE N.T.S. 5



TECHNICAL GROUND BUS - ALL IDF'S SCALE N.T.S. 2

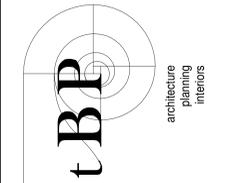


TECHNICAL GROUND BUS - BDF SCALE N.T.S. 1



FLOOR BOX DETAIL SCALE N.T.S. 4

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Los Angeles, CA 90012
ph: (213) 897-3995 fx: (213) 897-3159
agency



tBP Architecture
4611 Teller Avenue
Newport Beach, CA 92660
ph: 949.673.0300 fx: 949.732.3895
architect



FBA Engineering
Consulting Electrical Engineers
4611 Teller Avenue
Newport Beach, CA 92660
ph: 949.673.0300 fx: 949.732.3895
consultant

COMPTON COLLEGE
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owner

owner

IBP project number: 20998.00

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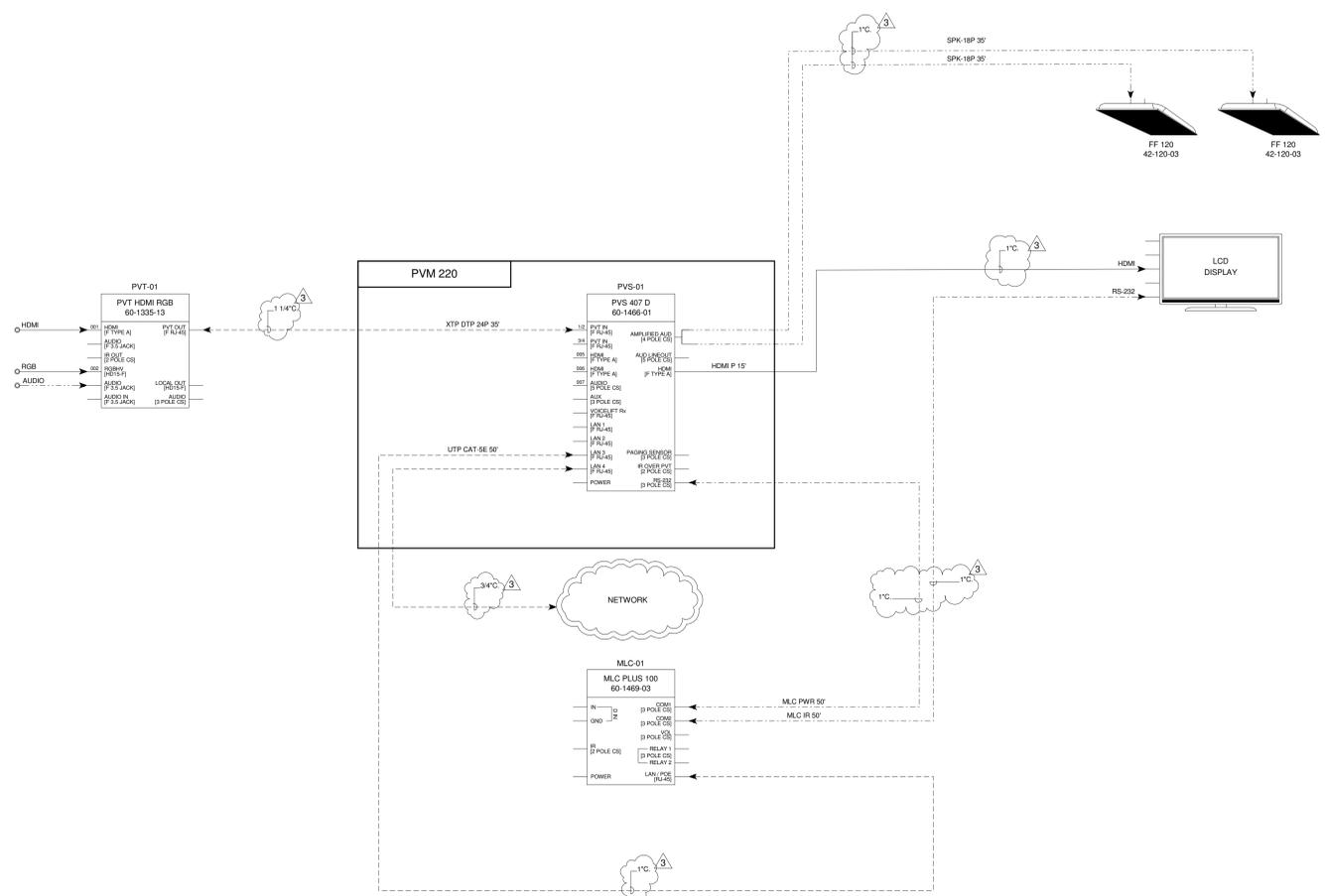
rev:	date:	description:
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2	09/04/19	Addendum 2
3	09/12/19	Addendum 3

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TELECOM DETAILS

drawing
ET-0.5
drawing of

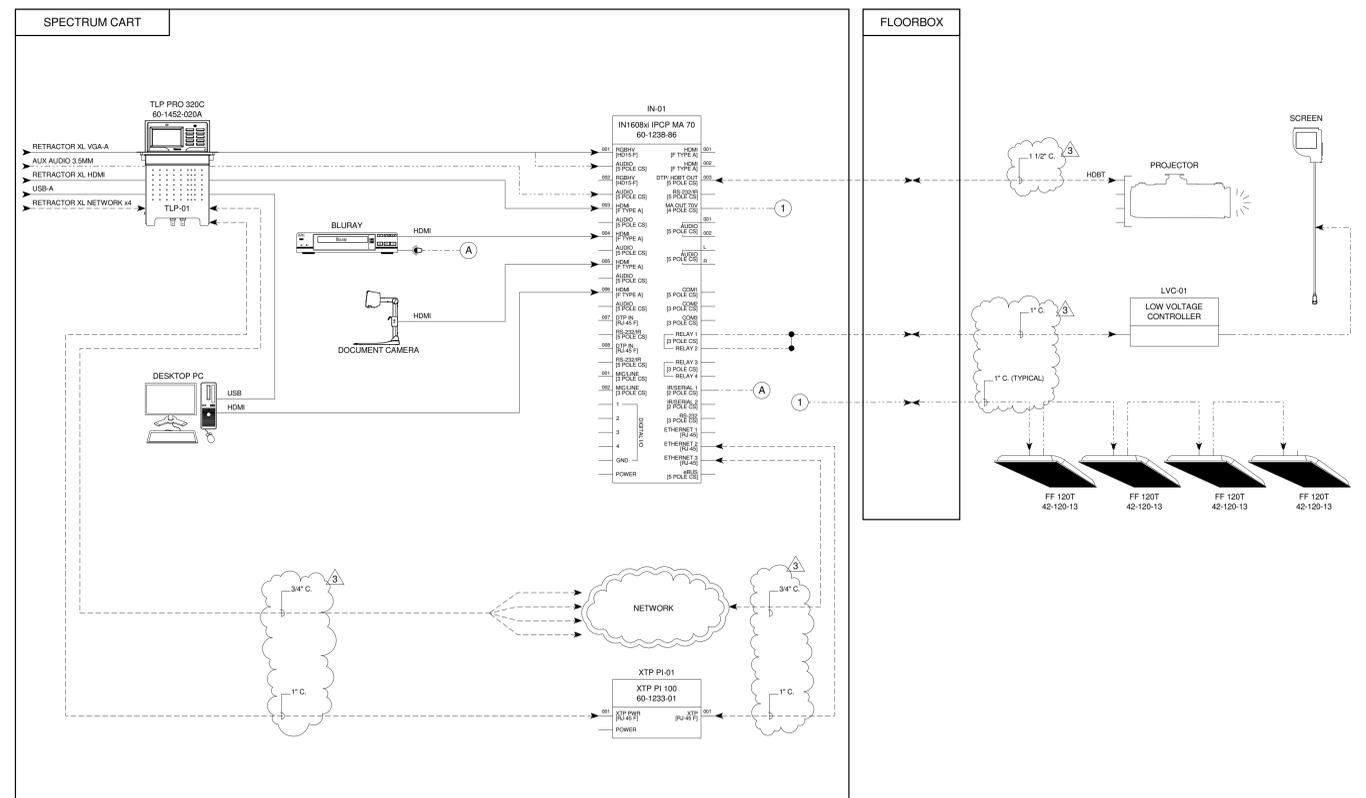
8/24/2019 5:21:01 PM



SMALL CONFERENCE ROOM

SCALE
N.T.S. 1

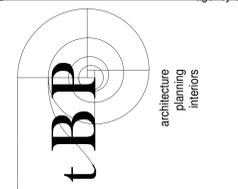
- AV PERFORMANCE NOTES:**
1. AV CONTRACTOR SHALL COORDINATE DIVISION OF WORK WITH THE GENERAL CONTRACTOR AND INCLUDE ALL COSTS IN BID.
 2. LECTERN CARTS, BLU-RAY PLAYERS, DOCUMENT CAMERAS, LCD DISPLAYS AND DESKTOP PCs ARE PROVIDED BY OTHERS. COORDINATE INSTALLATION WITH PROVIDER.
 3. PROVIDED COMPLETE AV AND ASSISTIVE LISTENING SYSTEMS IN ALL CLASSROOMS AND CONFERENCE ROOMS, NO EXCEPTIONS.
 4. PROVIDE INPUT IN AV EQUIPMENT FOR CONNECTION TO ALS.



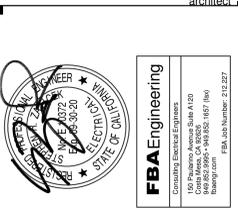
SMART CLASSROOM

SCALE
N.T.S. 2

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tBP Architecture
4611 Teller Avenue
Newport Beach, CA 92660
ph: 949.673.0300 fx: 949.732.3895
architect



consultant

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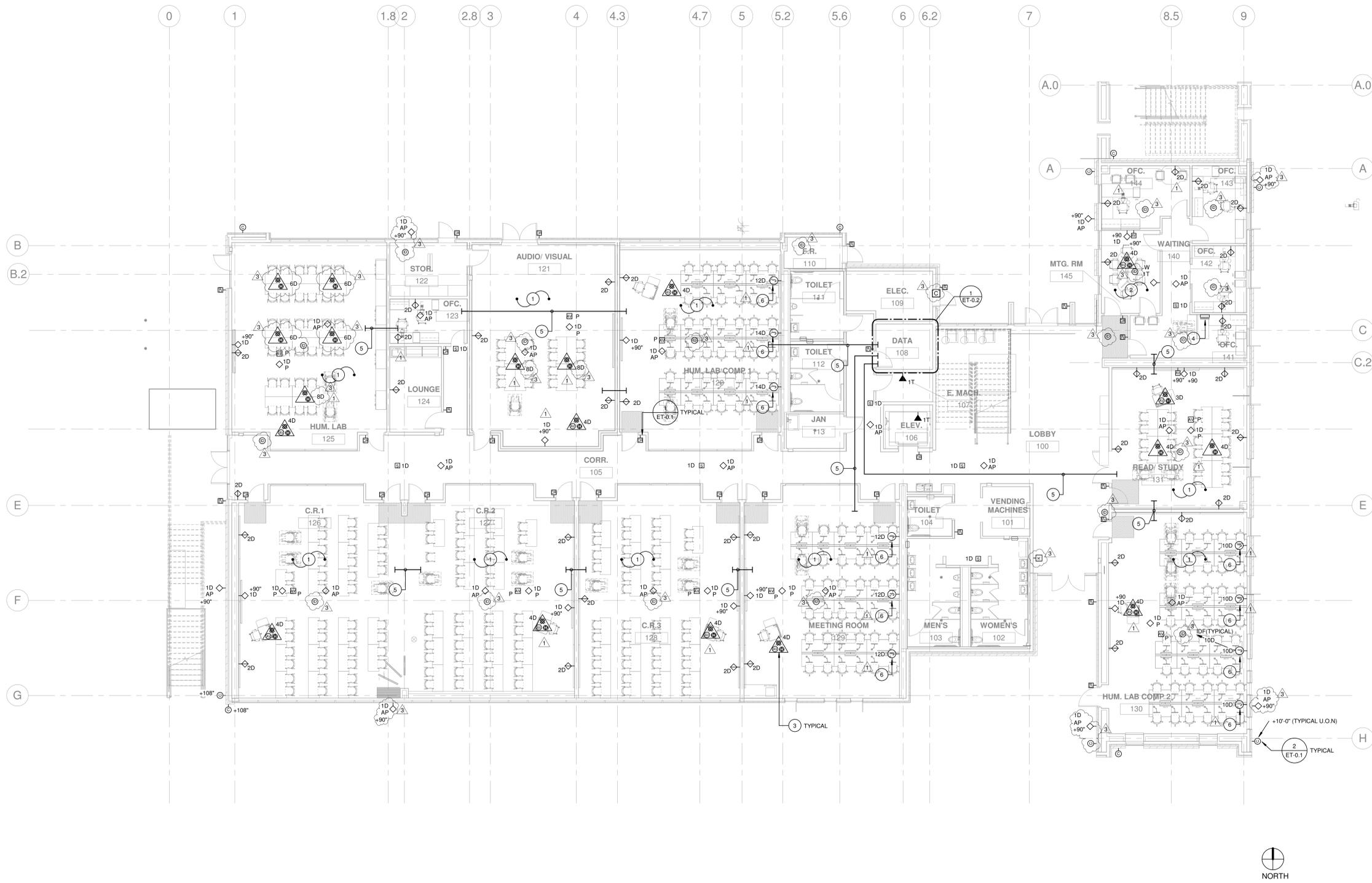
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rev:	date:	description:
1	08/02/19	Addendum 1
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AV WIRING DIAGRAMS

drawing
ET-0.6
drawing of

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FIRST FLOOR TELECOM PLAN

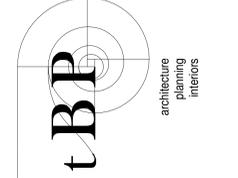
SCALE 1/8" = 1'-0"

1

KEY NOTES

- 1 PROVIDE COMPLETE CLASSROOM AUDIO/VISUAL SYSTEM INCLUDING CEILING MOUNTED PROJECTOR, PROJECTOR MOUNT, CONNECTOR PLATES, CONTROLLER, SPEAKERS, SOUND ENHANCEMENT AND ASSISTIVE LISTENING. REFERENCE ET-0.6.
- 2 PROVIDE COMPLETE CONFERENCE ROOM AUDIO/VISUAL SYSTEM INCLUDING LCD DISPLAY, CONNECTOR PLATES, CONTROLLER, SPEAKERS, SOUND ENTERTAINMENT AND ASSISTIVE LISTENING. REFERENCE ET-0.6.
- 3 INSTALL VOIP TELEPHONE, ONE (1) AT EACH LECTERN. PROGRAMMING SHALL BE PROVIDED BY COLLEGE. VOIP CISCO PHONES TO BE COLLEGE PROVIDED.
- 4 PROVIDE AREA OF REFUGE TWO-WAY COMMUNICATION COMMAND CENTER RATH 2500 SERIES OR EQUAL. PROVIDE ALL CONDUIT AND WIRING FOR A COMPLETE INSTALLATION. REFER TO SPECIFICATION SECTION 273000 FOR ADDITIONAL REQUIREMENTS.
- 5 PROVIDE TWO (2) 3" THROUGH WALL ABOVE CEILING FOR COMPUTER/DATA/VOICE/PA SYSTEM CABLING. PROVIDE INSULATED THROAT BUSHINGS ON CONDUIT ENDS.
- 6 PROVIDE VOICE AND DATA CONNECTIONS TO THE FURNITURE SYSTEMS IN ACCORDANCE WITH THE FURNITURE SYSTEM MANUFACTURERS REQUIREMENTS. PROVIDE QUANTITY OF DATA/VOICE CABLES AS INDICATED. ROUTE CABLING THROUGH FURNITURE SYSTEM RACEWAYS. PROVIDE DATA/VOICE TERMINATION DEVICES AT EACH WORKSTATION (TYPICALLY 2D) AND AT EACH PRINTER (TYPICALLY 1D) AS SPECIFIED AND IN ACCORDANCE WITH THE FURNITURE SYSTEM DRAWINGS. PROVIDE ALL CABLING, TERMINATION DEVICES, CABLE HARNESS, ETC. FOR A COMPLETE INSTALLATION.
- 7 PROVIDE WALL MOUNTED BATTERY OPERATED GPS TYPE CLOCK, +90° IN ALL ROOMS EXCEPT RESTROOMS, ELECTRICAL, DATA AND STORAGE ROOMS. TYPICAL.

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 Los Angeles, CA 90012
 ph: (213) 897-3995 fx: (213) 897-3159
 agency



IBP/Architecture
 4611 Teller Avenue
 Newport Beach, CA 92660
 ph: 949.673.0300 fx: 949.732.3895
 architect



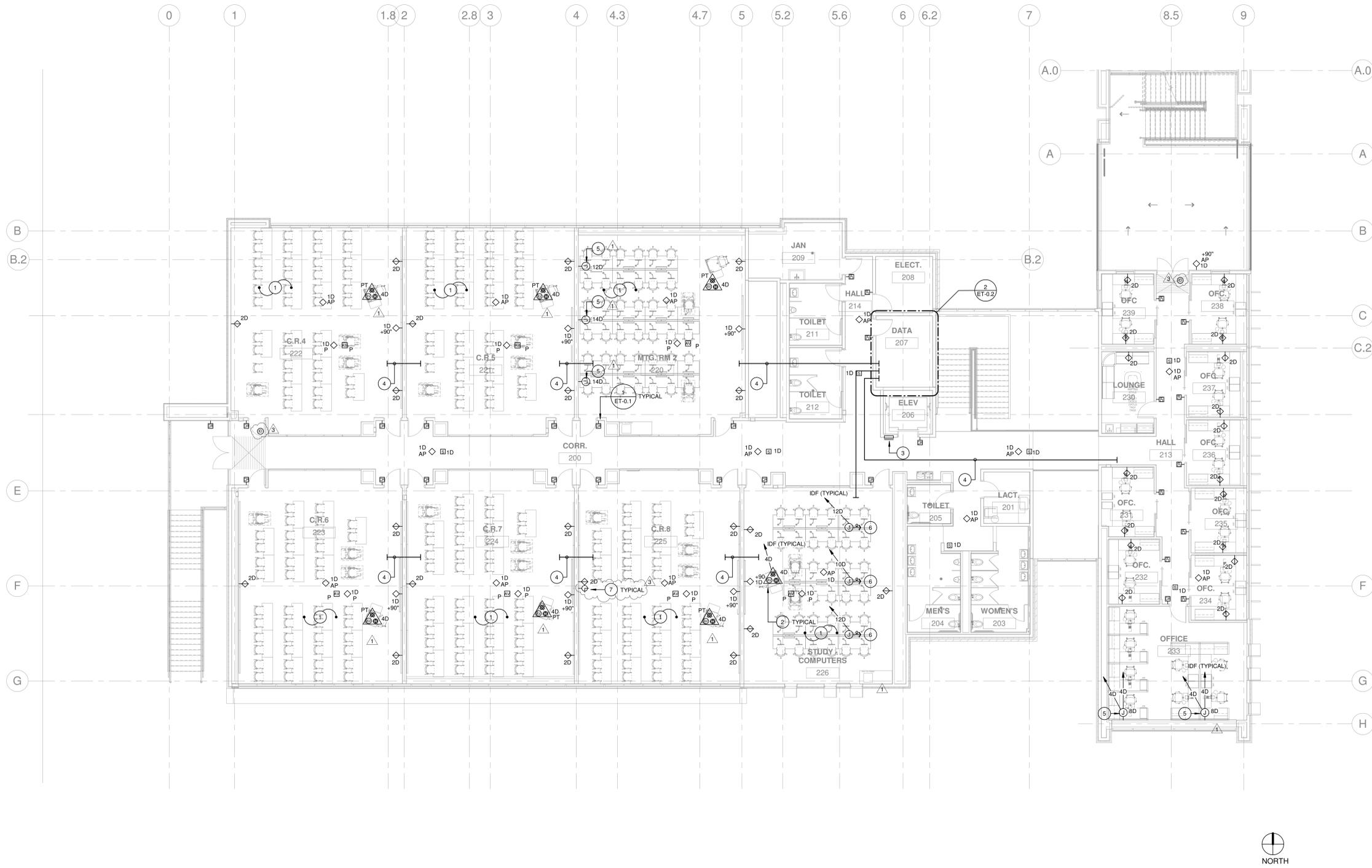
FBA Engineering
 Consulting Electrical Engineers
 4611 Teller Avenue, Suite 110
 Newport Beach, CA 92660
 ph: 949.673.0300 fx: 949.732.3895
 FBA Job Number: 212.227
 consultant

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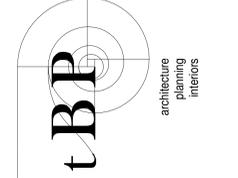
SECOND FLOOR TELECOM PLAN
SCALE 1/8" = 1'-0"



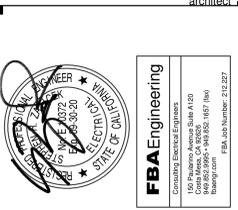
KEY NOTES

- 1 PROVIDE COMPLETE CLASSROOM AUDIO/VISUAL SYSTEM INCLUDING CEILING MOUNTED PROJECTOR, PROJECTOR MOUNT, CONNECTOR PLATES, CONTROLLER, SPEAKERS, SOUND ENHANCEMENT AND ASSISTIVE LISTENING. REFERENCE ET-0.6.
- 2 INSTALL VOIP TELEPHONE, ONE (1) AT EACH LECTERN, TELEPHONE AND PROGRAMMING TO BE PROVIDED BY COLLEGE. VOIP CISCO PHONES TO BE COLLEGE PROVIDED.
- 3 PROVIDE AREA OF REFUGE TWO-WAY COMMUNICATION SYSTEM COMPLETE WITH HANDS FREE ID CALL BOX AND SIGNAGE. PATH 2100 SERIES OR EQUAL. REFER TO SPECIFICATIONS SECTION 273000 FOR ADDITIONAL REQUIREMENTS.
- 4 PROVIDE TWO (2) 3" THROUGH WALL ABOVE CEILING FOR COMPUTER/DATA/VOICE/PA SYSTEMS CABLING. PROVIDE INSULATED THROUGH BUSHINGS ON CONDUIT ENDS.
- 5 PROVIDE VOICE AND DATA CONNECTIONS TO THE FURNITURE SYSTEMS IN ACCORDANCE WITH THE FURNITURE SYSTEM MANUFACTURER'S REQUIREMENTS. PROVIDE QUANTITY OF DATA/VOICE CABLES AS INDICATED. ROUTE CABLING THROUGH FURNITURE SYSTEM RACEWAYS. PROVIDE DATA/VOICE TERMINATION DEVICES AT EACH WORKSTATION (TYPICALLY 2D) AND AT EACH PRINTER (TYPICALLY 1D) AS SPECIFIED AND IN ACCORDANCE WITH THE FURNITURE SYSTEM DRAWINGS. PROVIDE ALL CABLING, TERMINATION DEVICES, CABLE HARNESS, ETC. FOR A COMPLETE INSTALLATION.
- 6 PROVIDE FLUSH IN FLOOR COMBINATION POWER/DATA FLOOR POKE THROUGH DEVICE WITH FURNITURE FEED COVER, FURNITURE FEED COVER SHALL HAVE MINIMUM 1 1/2" CONNECTION FOR COMPUTER/DATA/VOICE NETWORK CABLING AND 1" CONDUIT FOR POWER FEED CONNECTION. PROVIDE TELECOM CONNECTION COMPLETE WITH QUANTITY OF COMPUTER/DATA/VOICE CABLES INDICATED AND CONNECT TO THE FURNITURE SYSTEM. INSTALL POKE-THROUGH IN LOCATION PER THE FURNITURE SYSTEM DRAWINGS.
- 7 PROVIDE WALL MOUNTED BATTERY OPERATED GPS CLOCK, +90" IN ALL ROOMS EXCEPT RESTROOMS, ELECTRICAL, DATA AND STORAGE ROOMS.

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355 South Grand Avenue, Suite 2100
Los Angeles, CA 90012
ph: (213) 897-3995 fx: (213) 897-3159
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tBPArchitecture
4611 Teller Avenue
Newport Beach, CA 92660
ph: 949.673.0300 fx: 949.732.3895
architect



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